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ANNALS of SURGERY

VOL. LXXIX JUNE, 1924 No. 6

THE PRE-OPERATIVE PREPARATION OF HANDICAPPED SURGICAL PATIENTS

BY WALTMAN WALTERS, M.D.
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SECTION ON SURGERY, MAYO CLINIC

THE recent successful results following operations on patients handicapped with such conditions as diabetes, gastric retention, obesity, exophthalmic goitre, obstructive jaundice and urinary retention, are a great credit to the combined pre-operative treatment of internist and surgeon. Not more than three years ago, patients handicapped thus, were regarded as potentially grave surgical risks, and so accepted by the surgeon without due consideration of the possibilities of pre-operative preparation. The patient with diabetes, therefore, was denied operation, or if operation seemed unavoidable, the risk was from 8 to 10 per cent. Likewise little effort was made to clean an obstructed stomach until the morning of the operation. Immediate ligation of one or both superior thyroid arteries in many instances was the only preparation that the patient with exophthalmic goitre received. In cases of obstructive jaundice and of retention of urine resulting from hypertrophied prostate, immediate operation was often advised. Because of lack of preparation many patients with obstructive jaundice bled to death and the patient with retention of urine, sometimes went into uremic coma from the sudden decompression of the bladder. To-day all such patients are carefully prepared before operation by the internist and the surgeon, and operation is not performed until the patient is in the best possible condition for it.

Pre-operative Procedures.—The patient with diabetes is hospitalized under the care of the internist. A weighed diet is given, in which carbohydrates and fats are restricted until the urine becomes sugar and acetone free. It is sometimes advisable to assist in the assimilation of a larger amount of carbohydrate than the patient can take care of normally, by the aid of insulin.

The patient with gastric retention is under observation until the washings from his stomach are reported free from food particles. To accomplish this it may be necessary to wash the stomach two or three times a day, giving the patient a liquid diet, and maintaining the body fluids by means of proctoclysis or by the subcutaneous injection of a normal salt or a 2 per cent. glucose solution. If the obstruction is due to cancer of the pylorus, besides the pre-operative cleansing, preliminary gastro-enterostomy may be necessary as

advocated by Crile and Lilienthal; this is performed easily under local anæsthesia with very little risk, and ten to fourteen days later, when the patient's general condition has improved, as a result of being able to eat and assimilate food, he is in infinitely better condition for resection of the tumor than in the beginning.

The obese patient has been recognized as a grave surgical risk for years, not only because of the mechanical difficulty of abdominal operation, but because he is exceedingly prone to unfortunate complications such as fat embolism and infection. A high surgical risk in these patients may often be cut in half by placing the patient on a diet sufficiently low in calories to permit a loss of from 10 to 15 per cent. of body weight before operation. Keeping patients in bed for a week or ten days during this period of weight reduction, tends to assist in relaxing the abdominal wall.

The pre-operative treatment of patients with goitre depends much on the type of case, the exact clinical and physiologic condition, and the complications in each case. In cases of hyperthyroidism it is essential to distinguish the exophthalmic goitres from the hyperfunctioning adenomatous goitres. The administration of Lugol's solution to patients with exophthalmic goitre during the last two years at the Mayo Clinic seems to have reduced the post-operative mortality approximately 2 per cent., and the total mortality, including pre-operative and post-operative mortality from 3 to 4 per cent.

During the last two years approximately 100 patients with intense obstructive jaundice have been operated on, and only two have had severe post-operative hemorrhage. All of the jaundiced patients had had a daily intravenous injection of 5 c.c. of a 10 per cent. solution of calcium chlorid for a period of three days before operation. Also their body fluids and carbohydrate intake had been increased daily by large quantities of fluids by mouth, and glucose solution by proctoclysis.

In the last two or three years patients with retention of urine resulting from hypertrophied prostate have been much more carefully prepared than formerly. It is true that in certain instances the bladder was drained immediately by means of suprapubic cystostomy, and yet many of the patients died from uremia and infection. Hunt and Bumpus have been able gradually to relieve such obstruction by means of a water pressure apparatus. The apparatus is raised to a level that allows the bladder to empty through an indwelling urethral catheter, at the rate of not more than 1 or 2 c.c. in an hour, from twelve to twenty-four hours being required completely to empty the bladder. Thus the possibility is eliminated of congesting the kidneys, which may occur when back pressure, resulting from urinary obstruction, is suddenly released. The procedure makes it possible to perform a one-stage prostatectomy in from 75 to 80 per cent. of cases of hypertrophied prostrate. Adequate exposure of the interior of the bladder is obtained, a careful dissection of the hypertrophied lobes of the prostate can be made, and hemorrhage accurately controlled. In contrast to this operation is the blind two-stage operation, in which the prostate gland is dug out through a hole, about 1.5 cm. in diameter, which pre-

viously held the cystostomy tube. This procedure is often accompanied or followed by serious hemorrhage which greatly reduces the patient's resistance.

End-Results.—That the foregoing procedures in the preparation of handicapped patients are of value is shown by comparing the end-results in these various conditions in the Clinic, before and after such methods were instituted. Wilder reports a mortality rate of less than 2 per cent. in cases of diabetes in which operations were performed, as compared with 10 per cent. four years ago, and 30 per cent. as given by most of the standard text-books of surgery. Berkman reports that the mortality rate was reduced 50 per cent., in cases of gastric retention in which operation was performed during the last two years, and in which these pre-operative measures were employed. A similar reduction in the mortality rate in cases of exophthalmic goitre, in which operation was performed, is reported by Plummer, Boothby, and Pemberton. The mortality rate in cases of obstructive jaundice has decreased 50 per cent. in the last two years, since these patients have been adequately prepared.

GAS GANGRENE

By Charles Goodman, M.D.,
of New York, N. Y.

In 1882, Molier and Ponget first used the term "Gaseous gangrene" and from 1877 to 1881, Pasteur, Koch, Geffky and others isolated the bacillus which, because of its pathogenicity, was called the bacillus of malignant œdema. In 1892, Welch added the B. perfringens to this group. These have been increased until the group now consists of about 25 anaërobes and some 10 or 20 aërobes. The clinical classification of Weinberg and Seguin offers a convenient one for these lesions:

(a) Virulent gas gangrene. 1. Classical or emphysematous type. 2. Toxic or œdematous type. 3. Mixed form. 4. Putrefactive type. (b) Avirulent gas gangrene.

The Welch bacillus is the greatest producer of gas, and pure infections of it are apt to be the classical or emphysematous type. B. fallax and B. aerofœtidus are next in importance in the production of gas. The B. œdemoatiens and vibrion septique produce less gas and more œdema and predominate in the œdematous lesions. The mixed forms can be caused by any combination of the above, while the putrefactive group may show any and all combinations including the ordinary pyogens.

Major Coupal of the Army Medical School has called attention to the fact that muscle is a favorite tissue for these lesions and blood clots, blood serum, lung and liver are next in importance. Muscle only offers good soil for these infections, if it is damaged or its circulation is altered. Structures containing little muscle, like the hands, the feet, and the bones of the face are more rarely involved. Blood clots or serum in the pleura or peritoneum are common sites while the brain is fairly free from this infection. Muscle covered by dense fascia is a favorite location as the initial œdema and gas formation are transposed into tension by the restriction of these dense fascias and this further embarrasses the circulation and favors rapid spread of the process. The lower calf and the thigh are examples of this class while the buttock, and the sacral regions have the same factors plus the fecal contamination.

High explosive wounds are the most liable to these infections because of the contaminating element. Pieces of uniform or dirt, both, carrying the mambers of the anaërobes are often planted deeply in the tissues by the large fragments. These missiles usually produce more damage to the soft parts than do bullets. The infection begins to show clinical signs in from four to six hours after the injury. The high explosive wounds and the high velocity bullet wounds with much bone comminutions, mushroom effect or vascular lesions being favorite types. Histologically, the muscle fibre shows shrinkage, failure to take the usual stains and an œdema sometimes

amounting to the diameter of the muscle fibre itself confined within its sarcolemma. Bacteria usually found in larger quantities than in the ordinary infections occur in the connective tissue lining the finer muscle fibres. They seem to spread along these structures and are said by some to have the power of migrating along the coats of blood-vessels, especially when the structures have been damaged by hydraulics. The usual findings at autopsy in the true emphysematous types is the classical one of Welch septicæmia. These usually show a body-wasted jaundice, presenting a large foul smelling wound usually of the dense muscle areas with large quantities of hæmolyzed blood in the large vessels, a gas invaded foam-like clot in the heart and with all vascular intimas stained a deep red and with the so-called foam liver. This structure is soft, bright red and usually ruptures in manipulating. On section it yields quantities of hæmolyzed blood and fine bubbles.

Keith Inglis remarks that in war practice the mode of infection is similar in most instances. All cultivated soils are rich in anaërobic organisms originally derived from animal fæces, and shell wounds are frequently contaminated by such soil, the saccharolytic organisms most commonly found in infected wounds are bacillus Welchii, vibrion septique and bacillus œdematiens. They are responsible for the production of the spreading lesions of gas gangrene. Gas gangrene occurring in civil life may be divided into two classes according to the mode of infection. Class 1, includes those lesions in which like the gas gangrene of military practice, infection is due to contamination of the wounds by soil or material containing pathogenic anaërobes which originally came from animal feces. This class of lesions is not very uncommon and in the large metropolitan hospitals, wounds infected with gas producing bacteria are occasionally met with. Class 2, includes those lesions in which infection is not indirect by contaminated soil, but direct by the patient's own intestinal organisms. The type of lesion is uterine sepsis after abortion. Particularly criminal abortion. Inglis reports four cases of uterine sepsis ending fatally. In three instances gas bubbles were found in the liver and spleen, and the patient was probably infected by pathogenic anaërobes possibly from the patient's own alimentary tract. The endo-cardial valves, aortic intima, etc., were often dark red or even black in color. The intense generalized pigmentation seen in these three women was not observed by me in the soldiers who died from gas gangrene during the war.

Christopher says the early diagnosis is of the greatest moment. History of a recent wound, swelling, increased frequency of pulse rate, tympany, crepitus (auscultatory and palpatory), pale color of the skin, odor, ability to "milk" gas bubbles out of the wound, thin discharge, röntgenographic findings, and the maintained intelligence of the patient. In regard to treatment the preventive is naturally the most important. This consists of thorough early débridement of the wound, followed by dressing with Dakin's solution by the Carrel method, and delayed closure. It seems very desirable that serotherapy be more used in the preventive treatment. Once

gas gangrene has developed in a wound the first choice of attack is surgical. Radical removal of the gangrenous parts, multiple free incisions, and the Carrel-Dakin treatment should be employed. Christopher had a case of a structural iron worker whose left hand had sustained a severe crushing injury.

On admission 1500 units of tetanus antitoxin was given, and the Carrel-Dakin treatment of the wound was instituted. A week later a culture of the wound was reported as having gas bacilli as the predominating organism. Several phalanges were amputated and the raw area was skin-grafted by the Thiersch method from his thigh. The Carrel-Dakin was carried out daily. Eight months later the patient could write and row a boat.

Eugen Fränkel and F. Wohlwill confirmed from guinea pig experiments and autopsies on four cases that there is no foundation for the theory that the fatal termination of the gas gangrene infection is not caused by toxic effects on the central nervous system.

Barney and Heller found that B. Welchii and B. Chauvoei are notable muscle feeders. The vibrion septique group may feed on muscle, but they show a preference for connective tissue, and for serous linings, and they also show a remarkable facility for spreading along the lymph and blood channels. Their invasions are, therefore, not to be controlled by incision of individual muscles as are Welch infections. Many of the organisms of the œdematiens group fail to spread rapidly from the site of inoculation, and act by means of toxins that advance far before them.

Müller reported a case in which an operation started up an old gas bacillus (Welch-Nutall) infection, which had remained latent for one and a half years after a shell wound. After amputation of the leg the stump healed up, and an artificial leg was successfully adjusted. He thinks that a new infection was excised.

Van Gehuchten found in a large number of experiments with the ductless glands in guinea pigs, after infection with the gas bacilli that the alterations of the ductless glands are like those observed in other infections. The alterations are not marked in the thyroid and the pituitary, but are very deep in the suprarenal bodies. In the last named the hemorrhage lesions have always shown an extreme gravity. In the majority of cases in the animals who survived, there was a cortical insufficiency from lack of cholesterin, and a medullary insufficiency from deficient adrenalin secretion.

De Lavergne injected an emulsion of one of four gas bacilli into a guinea pig. One of these will be protected, and the same serum which has protected the guinea pig will protect the pig. In four per cent. of cases, all the animals succumb, not only the animals protected by a single serum, but even the animal protected by the simultaneous injection of the three serums. The gas gangrene is the work either of a typical v. septique or of b. sporogens, or some other aberrant germ.

Haberland reports that the blood-vessels in gas gangrene are injured as follows. As the bacillus invades the vessel wall, the endothelium is in-

jured, and the ground for a vital thrombosis formation is prepared. A serous hemorrhage suffusion of the subcutaneous and interstitial connective tissue will follow. The effect on the blood-vessels is thus a mechanical one although the toxin action is the definite one.

Sacquépée reported in 1920 at length on his experiments with gas gangrene. In a series of 191 cases of gangrene which he treated with Leclainche and Vallee's polyvalent serum or according to the De Lavergne method there were 166 cures and 25 deaths. The mortality in non-treated cases was 75 per cent. It can therefore be seen how far the curative treatment has been successful. It often operates in a striking manner, for in an entire series of cases in which any surgical interference was deemed inadvisable, the shock of the operation seemed bound to cause death and energetic serum treatment brought about such an improvement that the operation could be carried out subsequently at leisure with a minimum amount of danger.

Sacquépée emphasizes the value of preventive sero-therapy in cases of very severely wounded patients—particularly exposed to gangrene (arterial wounds, laceration of the buttock, thigh, etc.,)

Amongst 319 cases treated preventively only 4 cases or 1.17 per cent. of gangrene was observed. A series not treated by serum gave 7.2 per cent. gangrene. The value of preventive sero-therapy is evident since it reduces cases of gas gangrene to a very slight number of those wounds which are most exposed.

It appears from information at hand that gas infection of the virulent type does appear now and then in the surgical service of most hospitals. When it is present in the extremities, its progress is so rapid that it rarely is diagnosed early enough for hopeful eradication by surgical means alone. The value of an early exhibition of properly prepared serum as a life-saving measure is indisputable, and its efficacy as a preventive measure by inhibiting the growth of the virulent forms of gas bacillus deserves recognition by the municipal departments of health.

Death from tetanus would seem unpardonable on account of neglect of a prophylatic dose of serum administered in a case of street injury. Nevertheless, it appears that one of the most potent therapeutic measures discovered as a result of the recent world war is either forgotten or we have not had an epidemic of this gas infection brought home to us, to the realization that prophylactic measures might be applied to prevent the occurrence of such disaster.

Of the few cases reported in the literature that recovered without serum therapy, all had come to a high amputation. The recovery of my case was undoubtedly due to the efficacy of the serum. A careful inquiry as to the possible source of supply of serum for treatment of gas bacillus infection, reveals that there is but one private laboratory that maintains any supply at all while the laboratories of the department of health and those of the army and navy have closed their eyes completely to the necessity of maintaining a supply of this prophylactic and life-saving remedy.

CASE REPORT.—On Sunday, November 19th, a little girl aged nine was run over by a motorcycle and admitted to the Beth Israel Hospital with a deep, penetrating wound at the junction of the middle and lower third of the anterior aspect of the thigh. I saw her shortly after her admission and she presented considerable swelling due to hæmatoma. The wound was treated with iodine both this and the day following admission to the hospital. The report of the X-rays was negative.

The day following, which was Tuesday, the child presented an appearance of being very ill and her temperature had risen to 105°. An inspection of the thigh revealed everted edges of the wound, with no discharge. There was some discoloration of the skin. The child was immediately taken to the operating room. Upon incising the thigh, under anæsthesia, I found the extensor cruris muscle pulpified, of a terra cotta color and of gelatinous consistency. This destroyed and infected portion of muscle was excised. At least half of this muscle was involved. Underneath the extensor cruris was found a smudge which was made up of clot and hair, surrounded by liquefied muscle tissue. This was removed, and the contiguous and involved portion of the subcruris excised. The whole wound was iodized and the house surgeon instructed to prepare a Carrel-Dakin dressing with tubes for a flushing of the wound with the solution, every two hours.

The tissue excised was at once taken to the laboratory for immediate microscopic examination for possible gas bacillus. The report was submitted to me in about twenty minutes that the muscle tissue removed was infected with gas gangrene bacillus.

In the evening the child appeared to be extremely ill and stuporous. The thigh had become very much swollen and there were new areas of discoloration in the upper part of the thigh. The picture presented was that of the type of case for which, during the war, orders had emanated from the surgeon general's office: that gas gangrene evident to a great extent in the regions of the thigh should be treated by immediate amputation followed by the Carrel-Dakin dressing.

The gas bacillus is recognized as one of the most fatal forms of infection, and was responsible for the loss of many thousands of soldiers during the first two years of the war on account of temporizing and conservative measures then practiced. Amputation saved many lives in the war as the usual antiseptics applied to infections have little or no influence upon tissues contaminated with it. In 1917 I had an opportunity of witnessing the very interesting experiments made by Doctor Bull of the War Demonstration of the Rockefeller Institute. The doctor, who had been working very zealously, thought that he had perfected a serum which would combat the ravages created by the gas bacillus infection. One of the experiments I recall was made as follows: Healthy pigeons were inoculated with a small quantity of gas bacilli. These invariably died within a half hour. When the bird was placed in an incubator its body would in less than an hour swell up to at least twice its natural size, and an incision of the muscles would be followed by an escape of gas which could be illuminated with a match. Other pigeons from the same group, injected with a similar quantity of gas bacilli, and at the same moment injected with a dose of Doctor Bull's serum, remained alive and well. This serum was taken abroad and proved utterly worthless for the infection of gas bacilli because it was found later that there were other types of gas bacilli unknown to Doctor Bull in which his serum did not seem to have any influence whatsoever.

The girl whose case I am now reporting, was given 105 c.c. of the serum obtained from the Lederle Laboratory. The serum was a mixture of Welch perfringen's form of the gas bacillus type with tetanus. The patient developed a chill, and the administration was discontinued at that point. No amputation was done owing to the opposition of the family.

During the next two consecutive days the child received two more doses of the serum of 100 c.c. each and then began to show continued improvement. At the end of three weeks the wound was practically bacterially free, and I performed a secondary

suture with an almost perfect primary union. Since then the child has been walking around and has recovered an almost perfect restoration of the function of the muscle by hypertrophy.

Upon inquiry I learned that at one of the hospitals, which has a very large ambulance service, that there were no less than three cases of gas gangrene treated in the course of a year, two which terminated fatally and the third recovered after an amputation of the upper extremity.

In the Journal of Railway Surgeons there are two cases of gas bacillus infection reported which occurred in the practice of Doctor Edmondson. One of these was the case of a boy who had fractured his leg which showed within forty-eight hours evidences of gas gangrene. A high amputation saved the boy's life. The other was a man of fifty years of age who had pricked his finger and gas gangrene set in. An amputation at the shoulder and repeated blood transfusion saved the man's life. Neither one of these cases was treated with serum.

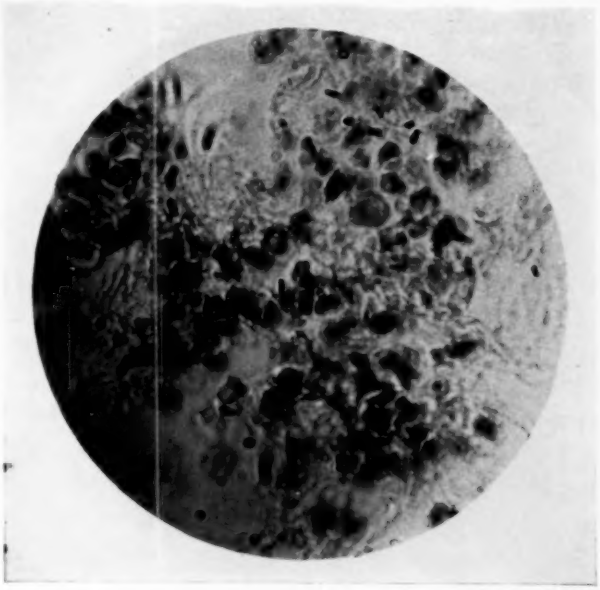

FIG. 1.—Microscopic section of tissues removed from patient. Bacteriological report by Morton C. Kahn. Morphologically the bacteria in the specimen are very characteristic of the Welsh type of gas gangrene bacillus. They are short, plump, gram bacilli with square end, and a diligent search reveals no spore bearing form.

Another case was reported during this last year in the Archives of Surgery by Barney and Heller, of San Francisco. This case resulted in a high amputation of the arm. Attention is called to this case of unusual form of infection in order to show that while it is a rare form, it does appear now and then in the course of our experience, and it must be treated radically, without delay. Any attempt to temporize is likely to be followed by a fatal outcome.

The bacteriological report on the slides of the tissues removed from the patient made by Dr. Morton C. Kahn. Morphologically, the bacteria in the specimen are very characteristic of the Welch type of gas gangrene bacillus. They are short, plump, gram bacilli with square end, and a diligent search reveals no spore bearing form (Fig. 1). The organism œdematiens also gives similar characteristics. The morphology being, however, a more slender organism, and having tendency to sporulate. The Welchii does not spore in the presence of carbohydrate, such as is present in the muscle.

He further states that the morphology of the bacteria presented have all the characteristics of the Welchii type. Doctor Williams, assistant to Doctor Park (Board of Health Laboratories), reported as follows: The specimen of bacteria presented, presents all the characteristics of an anaërobic form of bacillus. The appearance of the bacteria is characteristic of the virulent anaërobic gas bacillus, several groups of which have been isolated. While it cannot be stated with absolute certainty to what particular group these bacteria belong, without reproduction by culture, the appearance of the slide is nevertheless quite characteristic, and really could not be mistaken for anything else than one of the gas gangrene producing bacilli.

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THE INCIDENCE OF POST-OPERATIVE CATHETERIZATION IN THE JOHNS HOPKINS HOSPITAL*

By Ralph G. Mills, M.D.
of Peking, China.

The attitude of the profession toward catheterization after operation has undergone considerable change during the last decade. Formerly the indications for the use of the catheter were ill-defined, some employing it freely whenever there appeared to be any complaint of distention in the lower abdomen from any cause, others, fearful of producing a cystitis, seeking to avoid its use except in cases of obvious overfilling. Methods were devised which sought to render the procedure free from danger by strict attention to asepsis and thorough cleansing of the meatus. Occasionally irrigations of the bladder or instillations were employed, but without any clearly defined indications or scientific basis for their use. The importance of residual urine as a predisposing factor in post-operative cystitis was occasionally mentioned. Its presence before operation was rarely looked for and post-operative retention was expected in a considerable number of cases. These were catheterized as a routine measure at regular or irregular intervals until the patient was able to void without assistance. If no obvious cystitis developed, no further attention was paid to the bladder or the possible presence of residual urine. Here and there a voice was raised in protest, notably Taussig, Kolischer and Curtis, but apparently little attention was paid to their suggestions.

Surgical progress was, however, being made along certain relevant lines, such as increase in the rapidity of operating, the elimination of trauma to tissues left behind, the use of better anæsthesia and the reduction of pain and discomfort after operation. A careful, detailed comparison of the various methods employed would doubtless reveal many instances of altered technic in operation or dressing that influence the urinary mechanism.

A comparison was made between an American series [1] and one collected in Korea [2] in order to determine the influence of race and necessary methods of hospitalization upon the urinary function as affected by operation. However, the interval between observations was so long (9 years) that the effect of improved technic could not be safely disregarded. In view of contemplated studies upon another Oriental race, the Chinese, it was felt that such a series as that embodied in this paper would bring to light the results of any such alteration in operative procedure and improvement in the attitude toward catheterization.

Personal observation of any of these cases has not been possible, the data being entirely obtained from the hospital records, to which access was secured through the permission of Dr. Ralph B. Seem, Assistant Superintendent, and

* From the Department of Pathology, Peking Union Medical College.

the cordial coöperation of Miss Frances Riach, Custodian of Records. Drs. J. P. Maxwell and A. S. Taylor, at that time connected with the Departments of Gynecology and Surgery respectively, have kindly furnished much collateral data in regard to the various regulations and procedures. Miss Anna D. Wolf, formerly of the nursing staff, has also added valuable information. My special thanks are extended to Drs. T. S. Cullen, Guy L. Hunner, D. B. Casler, E. H. Richardson, and L. R. Wharton for their sympathetic interest in this investigation and their many helpful suggestions.

The cases summarized are from the surgical, gynæcological and urological services of the Johns Hopkin's Hospital and include practically all those operated between June 1, 1918, and February 15, 1920. Only those are here considered which conform to the postulates laid down in the first article. In brief they are as follows:

1. The operation must have involved the cutting of tissue.
2. It must have been performed under general oral anæsthesia.
3. The patient must not have been comatose before or abnormally long after operation.
4. Patients must have been twelve or more years of age.
5. They must have had apparently normal control of the urinary function.
6. They must have lived at least twelve hours after operation.
7. Obstetric operations of all kinds are excluded.
8. All cases have been disregarded where drainage with a retention catheter was maintained or where catheterization was done at short intervals for reasons connected with the particular operation.

The operations conforming to these limitations are divided into the following 14 groups:

1. Operations on the rectum and anus.
2. Operations on the penis and scrotum, including the male perineum.
3. Operations on the vagina, including female perineum, but excepting dilatation of the cervix and curettage.
4. Abdominal operations involving the female pelvic organs.
5. Dilatation and curettage of the uterus.
6. Operations for hernia, inguinal and femoral, both sexes.
7. Operations on the kidney and ureter.
8. Operations in the abdomen not gynæcological, including abscess and operations on the liver.
9. Operations on the chest, abdominal wall, back and hips.
10. Operations on the arm.
11. Operations on the leg, including inguinal suppuration.
12. Operations on the head and neck, except Nos. 13 and 14.
13. Operations on the mastoid.
14. Operative removal of tonsils and adenoids.

The routine for the care of gynæcological patients, so far as it concerns this study, contains the following orders to nurses and house officers:

I. Admission of Patients.—Water forced. Specimen of urine to the laboratory. If patient does not void for 12 hours, notify doctor.

II. Preparation for Operation.—Nothing by mouth after midnight except water. Voided specimen to laboratory, morning of operation. Catheterization of all patients under anæsthesia before operation.†

III. Post-operative Care.—Water forced. All patients may be turned in bed unless otherwise ordered. No patient may sit up, get into a chair, or walk without orders. Specimen of urine to laboratory morning after operation and q. 7 days. Catheterization orders for all patients except D. and C.

1. If patient is uncomfortable, she may be catheterized at any time after 8 hours following return to the ward. If the patient is comfortable, she need not be catheterized until 12 hours after her return.

2. After the first catheterization, she shall be catheterized q. 12 hours until she voids 100 c.c., or more at one time.

3. After D. and C. no patient is to be catheterized except by special order.

4. Patient may be raised in Gatch bed, if necessary, to assist her to void.‡

5. When any patient who is not being catheterized has not voided for 12 hours, notify doctor.

Bladder instillation, silver nitrate, 1-2000, oz. 1, is to be given daily if patient has to be catheterized over 36 hours. This treatment is to be continued as long as the patient has to be catheterized.

The routine on the surgical service was not so explicit in regard to catheterization, each case being subject to individual orders. When a patient did not void, the interne was notified and efforts were made to bring about urination. If the bladder was not distended and the patient was comfortable, he was allowed to wait. Fluids were forced if possible, warm enemas used and the patients allowed to rise up or stand when advisable from the operative point of view. No definite time limit was set within which every patient must urinate or be catheterized.

The use of drugs before and after operation has apparently been quite free. A preliminary injection of morphine 1/6 gr. and atropine 1/100 gr. was the rule, except with children, and was often repeated within the first 6 hours or sooner; in case of great pain it was given again. Complaints of pain from gas were often noted on the charts and in such cases eserine 1/100 gr. and strychnine 1/40 gr. were commonly employed. No instance where benzyl benzoate was used to overcome the spasticity induced by morphine was observed. Pituitrin was also occasionally administered.

I. OPERATIONS ON THE RECTUM AND ANUS

All of the catheterized patients were women, of whom six had a suture of the rectal sphincter as part of a perineal repair. All except one had some form of associated vaginal operation. Fourteen hours was the longest time that elapsed before the catheter

† Personal communication from Dr. Guy L. Hunner.

‡ Personal communication from Dr. D. B. Casler.

was used. In this case the patient had voided 30 c.c. before catheterization, the catheterized specimen measuring 250 c.c. Another patient with suture of the sphincter and perineal repair was catheterized after seven hours by special order. The amount obtained was 250 c.c.; "slight discomfort" was noted on the chart. The patient from whom a rectal polyp was removed was "waked for treatment" (*i.e.*, catheterization) at the expiration of twelve hours, in spite of the fact that she had voided 50 c.c. one and one-half hours before. Much nausea and vomiting was noted in one history and "very nervous" in another. One woman seventy-one years of age was catheterized a great many times after an operation for hemorrhoids and anterior and posterior colporrhaphy. She was "uncomfortable from bladder distention" and by catheter 275 c.c. were withdrawn. Approximately every eight hours thereafter the catheter was used, yielding the following amounts: 200, 500, 450, 150, 350, 425, 400, 400, 150, 225, 200, 100, 500, 325, 850, 800,

TABLE I

Operation	Catheterized	Voided
Fistula	..	11
Hemorrhoids	2	31
Hemorrhoids and fistula	..	1
Abscess	..	8
Mucous polyp	1	..
Atresia ani	..	1
Suture of sphincter	6	2
Carcinoma (Kraske)	..	2
Ulcer excision	..	4
Fissure	..	1
Totals	9	61

250 and 925 c.c. After the fifth catheterization the note is made, "no complaint." The charting was discontinued while the patient was still being catheterized. There were no urinary records on the charts to indicate the condition of the urine, but there was evidently no serious difficulty or the records would have had some special entry. There was apparently an atonic condition of the bladder and the irregularity of the size of the specimens obtained suggests a variation in the technic used and the presence of considerable residual urine. The amounts stood in no relation to the diet, time of day, or any discoverable factor. Two of the women were colored and seven were white.

Of the non-catheterized patients 37 were men and 24 women; 42 were white and 19 colored. As compared with the St. Luke's series, there was a notable decrease in the frequency of catheterization in three groups, namely, fistula, hemorrhoids and perirectal abscess. Formerly these were dressed with large gauze packs or rolls of gauze of which the patients frequently complained bitterly. Several stated that the presence of the dressings prevented them from urinating, the truth of their statement being evident when they voided without difficulty after its removal. The two patients subjected to the Kraske operation for cancer of the rectum voided without difficulty after eleven and eighteen hours, respectively. On only four of the patients who voided was any gynæcological operation done.

2. OPERATIONS ON THE PENIS AND SCROTUM, INCLUDING THE MALE PERINEUM

One patient operated for double hydrocele was catheterized after twenty hours, withdrawing 75 c.c. Note on the chart stated that the man was "quiet and comfortable." The St. Luke's figures were 4 catheterized and 18 voided. The tendency of surgeons

TABLE II

Operation	Catheterized	Voided
Varicocele	..	16
Varicocele and hydrocele	..	2
Circumcision	..	2
Epididymectomy	..	17
Castration	..	9
Periurethral abscess	..	2
Hydrocele	1	21
Perineal fistula	..	5
Vesiculectomy	..	6
Miscellaneous	..	9
Totals	1	89

to delay the use of the catheter is here shown very clearly. Thirty-five patients urinated voluntarily within eight hours after operation and 52 delayed longer. It is impossible to say how many of the latter group would have been able to void within eight hours if they had been urged to do so.

3. OPERATIONS ON THE VAGINA, INCLUDING FEMALE PERINEUM

Several operations were more complicated than would appear from the table above. There were 3 vaginal suspensions of the uterus; 2 of the patients voided. The urethral orifice was repaired in 3 individuals, 2 of them being catheterized, the charts leaving an

TABLE III

Operation	Catheterized	Voided
Plastic repair in vagina	4	20
Perineal repair	18	18
Pelvic puncture	6	27
Miscellaneous	2	6
Totals	30	71

uncertainty as to whether or not this was done by special order. In grouping the cases the most important or extensive operation was selected, having in mind the possible influence of the procedure upon the nerve or blood supply of the urethra and neck of the bladder. Fifteen patients on whom colporrhaphy was performed were cathe-

terized and 5 voided; of those in whom vaginal fixation was done, 2 urinated and 2 were catheterized.

4. ABDOMINAL OPERATIONS ON THE FEMALE PELVIC ORGANS

A classification of operations involving the wide variety of combinations would have been very cumbersome. Simple hysterectomy was usually done for uterine tumors of benign nature, whereas pan-hysterectomy with removal of the adnexa covered the malignant tumors and extensive pelvic changes

TABLE IV

Operation	Catheterized	Voided
Uterine suspension	43	38
Hysterectomy, simple	16	20
Hysterectomy and removal tubes and ovaries	57	56
Removal tubes or ovaries (uni- or bilateral)	29	62
Totals	145	176

following prolonged infection. Cases involving the removal of tubes and ovaries on one or both sides for all causes were grouped together. Suspension of the uterus, whether alone or combined with other operations, was considered as a single group because of the mechanical effect upon the bladder. All four groups of operations were believed to influence more or less the nerve and blood supply to the bladder and hence to be directly related to the patient's control of micturition.

Subject to the rules in force governing the post-operative catheterization of gynæcological patients, it appears that a little more than half of the women voided without instrumental assistance. This ratio, however, is not maintained in all the groups. The effect of pressure of the uterus against the bladder is seen in the fact that forty-three were catheterized and only thirty-eight voided. A further analysis of the cases shows:

Operations	Catheterized	Voided
Uterine suspension alone	—	9
Combined with adhesions	4	3
Combined with appendicitis	2	5
Combined with other pelvic operations	37	21
Totals	43	38

Apparently, then, uterine fixation alone did not interfere with urination, but when combined with other operations, particularly those on the pelvic organs, a distinct influence was noted.

Removal of the supravaginal portion of the uterus, as for uncomplicated fibromyomata, had little effect upon bladder function. Only two such simple operations are included in the catheterized group, and twelve of the other

fourteen were combined with appendectomy. In the non-catheterized group there were four simple hysterectomies and sixteen combined with appendectomy. The number of appendices removed would indicate that this was almost a routine measure. Comparison of these two small groups indicates also that when the abdomen is once opened for any operative procedure the additional trauma incident to an appendectomy has little or no influence upon the urinary mechanism. Such interference as is noted in simple appendectomy must be attributed largely to the laparotomy and the technic that goes with it.

Complete removal of the uterus and more or less of the adjacent organs is a more formidable operation, the number of catheterized patients being equal to the non-catheterized. The influence of the additional removal of portions of the adnexa is suggested by the fact that when these alone were removed, more than twice as many patients voided as were catheterized. Proper deductions must be made in this group for the influence of the laparotomy, as was noted in the case of appendectomy.

5. DILATATION AND CURETTAGE OF THE UTERUS

This operation alone was employed in the treatment of seventy women of whom three were catheterized. Patients after this operation were allowed to go longer than in the two preceding groups of cases, the periods being 16, 25 and 12 hours. The amounts recovered were 875, 400 and 300 respectively. They were all young married women, aged twenty-six, two colored and one white, and were very uncomfortable after operation. The white woman whose bladder contained 400 c.c. was the only one who complained of " fullness in the bladder region." The catheter was used only once in each case. The voiding interval in the non-catheterized cases averaged a little over 8 hours, the extremes being 1 and 17 hours.

6. OPERATIONS FOR HERNIA, INGUINAL AND FEMORAL, BOTH SEXES

In the group of catheterized patients there were 2 women and 5 men, one of the women being colored. Of those that voided 16 were women and 159 men. Forty-one of the individuals were colored and 134 white; the

TABLE V

Operation	Catheterized	Voided
Inguinal, direct	3	10
Inguinal, indirect	3	138
Inguinal, double	1	21
Femoral	0	6
Totals	7	175

number of colored women with inguinal hernia seemed disproportionately large. In 2 of the catheterized patients it seems all together likely that preoperation urination was forgotten, as 950 and 500 c.c. were withdrawn after

2 and 6 hours respectively. Six hundred c.c. were obtained from a third patient after 7½ hours. Five of the patients were catheterized only once and in all of them pain and discomfort were specially recorded. One was catheterized twice and one five times. The amounts in all instances were up to or above the average.

The time interval for the voided cases was extremely variable, but the average was high. The maximum amount for the whole series is found in this group, 1750 c.c., voided after an interval of 28 hours. There was no evidence that the patient was injured by the unusual distention or that urination was affected during the remainder of his stay in the hospital.

7. OPERATIONS ON THE KIDNEY AND URETER

Eighty-eight reports are here considered; 11 patients were catheterized from 1 to 3 times. The amounts recovered by catheter and after voiding show the greatest variation, from 10 c.c. after a 12-hour interval to 925 c.c. after 10

TABLE VI

Operation	Catheterized	Voided
Nephrectomy	8	56
Nephrotomy—unilateral	2	7
Nephrotomy—bilateral	1	..
Ureterotomy	..	5
Pyelotomy	..	9
Totals	11	77

hours. In the latter case it is highly probable that the patient did not urinate immediately before operation. Morphine had been freely used before and after operation and this seemed to be an important factor in disturbing the urinary mechanism, especially in the catheterized cases. "Distention" and "discomfort from inability to void" were more frequently noted on the charts than in any of the preceding groups of cases.

The possible effect of the kidney operation upon the urinary output was of supreme importance in many of these cases and doubtless led to the use of the catheter after such short inetrvals as 3 to 5 hours for the sole purpose of diagnosis. A tabulation of the nephrectomy cases according to the urination interval and output gives a surprising lack of uniformity in results. One patient after 2 hours passed 150 c.c. and another voided 300 c.c. after 17 hours. Six of the recorded amounts were below 100 c.c. and represented either incomplete samples or an abnormally low rate of excretion. Nephrotomy, pyelotomy and ureterotomy had a more noticeable effect upon the initial urinary output than nephrectomy.

8. OPERATIONS ON THE ABDOMEN NOT GYNÆCOLOGICAL

The most noticeable advance in surgical procedure indicated by the operations listed is the frequency with which the more serious operations, such as splenectomy and resection of the stomach, were undertaken. Excision of

TABLE VII

Operation	Catheterized	Voided
Exploratory laparotomy	3	28
Fecal fistula	1	4
Appendectomy	27	155
Gastro-enterostomy	2	18
Gastrotomy	0	11
Gastrectomy for cancer	0	7
Cholecystotomy	0	9
Cholecystectomy	8	42
Cholecyst-enterostomy	0	1
Choledochotomy	2	4
Cholostomy	0	7
Enterotomy	0	1
Entero-enterostomy with resection	1	12
Intestinal obstruction	3	3
Peritonitis with drainage	0	18
Adhesions	4	15
Liver abscess	0	12
Retroperitoneal cyst	0	2
Splenectomy	1	3
Ventral hernia	3	12
Miscellaneous	0	1
Totals	55	365

the gall-bladder has largely replaced cholecystotomy and appendectomy has become still more frequent. Liver abscess is more often diagnosed and treated by operation than in former years, possibly indicating an increase in amœbic infection, an intestinal condition occasionally found in the vicinity of Baltimore.

In general the operations in the upper abdomen were not so likely to influence the function of the bladder as those on the organs lower down. Most patients were catheterized after 10 hours, the periods ranging from 11

to 20 hours or longer. Twenty-two patients were catheterized 2 or more times and of this number all but 2 were women. Five of the catheterized patients were colored, all of them being women. Seven was the greatest number of times any person was catheterized, this patient being a psychopath who had a checkered post-operative record and who was transferred to the psychiatric service upon recovery from this operation. None of the operations involved the bladder in any way.

In this group 45 per cent. of the patients were women, a proportion somewhat smaller than it would have been if all who had any operation on the pelvic organs had not been so rigidly placed in group 4. As it stands, however, four times as many women were catheterized as men. A list of the operations done on the male patients catheterized shows them to be of a more severe grade. They are: appendectomy, 7 cases; gall-bladder, 3; and splenectomy, fecal fistula, resection and intestinal obstruction, 1 each. The frequency of bladder difficulty, even in the operations of lesser degree, suggests strongly either the prominence of the nervous element or the existence of a previous pathological condition of the bladder, or both.

9. OPERATIONS ON THE CHEST, ABDOMINAL WALL, BACK AND HIPS

Seven of these patients were catheterized and 123 voided without assistance. Five of the former were women and all were white. The amount of urine withdrawn was over 500 c.c. in all except one case where after 22 hours

TABLE VIII

Operation	Catheterized	Voided
Amputation of the breast	2	45
Abscess and sinuses	..	12
Osteomyelitis	..	8
Thoracotomy	..	34
Tumors	1	9
Bone graft (Albee)	3	6
Plastic operations	..	2
Laminectomy	..	7
Incision and cautery	1	..
Totals	7	123

250 c.c. were obtained. Confinement in a plaster bandage and much pain were noted as contributing factors, but there were no symptoms referable to bladder distention. One woman whose breast was incised and cauterized was catheterized after 23 hours and 700 c.c. of urine withdrawn. One man from whose chest wall a tumor had been removed passed small quantities, as 50 c.c., 40 c.c. 75 c.c., etc., at intervals for 25 hours and was finally catheterized with the recovery of 750 c.c. He was in extreme pain but not because of a full bladder.

A woman of fifty-two with complete breast amputation was catheterized 10 times, the first time after 20 hours with removal of 750 c.c. Urotropin treatment was begun the second day and the cystitis was said to have cleared up before discharge. The cases of Albee bone graft to the spine were more seriously inconvenienced than the other operative cases, the supine position and pain, chiefly in the leg, were especially commented upon. These 3 were all young women in some of whom nervous symptoms were quite pronounced. There is no evidence that any local changes in the cord in the region of the graft affected the bladder control. No other pressure symptoms were noted in the history of these patients. Operations of lesser severity allowing the patients more freedom of motion in bed were not attended with any functional disturbances of the bladder.

10. OPERATIONS ON THE ARM

In all, 67 patients were treated, all of whom voided. The series contained the usual proportion of amputations and incisions for infection, osteomyelitis, tumors and plastic operations.

11. OPERATIONS ON THE LEG

Two hundred patients were operated for conditions affecting the leg, of whom 3 were catheterized. One young soldier whose leg had been amputated was catheterized once after an interval of 21 hours, at which time 625 c.c. were removed. He had great pain from twitching of the muscles and was given morphine freely for its control. Bladder distention was distressing. This man was again operated 10 days later for infection of the amputation stump and 400 c.c. of urine were removed by catheter after 7 hours. The other case, also a young man of the same age, had an open reduction of a fracture of the femur with insertion of a bone splint. He, too, was in great pain; nausea and vomiting persisted and some shock was present. Morphine was given freely. Six hundred c.c. were removed by catheter after an 11 hour interval.

12. OPERATIONS ON THE HEAD AND NECK

This group includes 475 operations of very diversified nature. Operations on the thyroid were performed on 161 patients and brain surgery was conspicuous on the list. Seven patients were catheterized, of whom four were operated for thyroid conditions. The numerous entries on the charts indicate the extreme nervous condition of these patients. "Worried over self," "nervous and worried," "noise in the head," "twitching of body," "teeth chattering," were notations usually indicating hyperthyroidism. One young woman of eighteen on whom a plastic operation on the nose was performed was relieved by catheter of 800 c.c. after an interval of 22 hours. The charts spoke of her as "kicking and crying" and "very unreasonable." The other two operated patients, one for hypophyseal tumor and the other for decompression, were not characterized in any special way on the charts, but there is some lingering doubt as to whether or not they were in full possession of their mental faculties. Each was catheterized twice at intervals of from 14 to 26 hours with the recovery of from 300 to 600 c.c. of urine.

13. OPERATIONS ON THE MASTOID

Thirty-nine operations are recorded with only one patient catheterized. In this case the reason for the urinary difficulty was not apparent. He was an unmarried farmer, fifty-three years of age, who was relieved of 775 c.c. after an interval of 24 hours. He was charted as being "very thirsty," although no water was given him until after midnight. There was no mention of nausea and vomiting although he was in considerable pain.

14. REMOVAL OF TONSILS AND ADENOIDS

In all there are 230 operations recorded. No patient was catheterized.

TABLE IX
COMPARISON OF CATHETERIZED DATA, ST. LUKE'S AND JOHNS HOPKINS

	St. Luke's		Johns Hopkins	
Groups of Operative Cases	Catheterized	Voided	Catheterized	Voided
1. Operations on the rectum and anus.....	16 48.7%	17	9 12.9%	61
2. Operations on the penis and scrotum...	4 18%	18	1 1.1%	90
3. Operations on the vagina, and adjacent perineum (excluding No. 5)....	4 18%	18	30 29.7%	71
4. Abdominal operations on the female pelvic organs.....	8 22%	28	145 45.2%	176
5. Dilatation and curettage of the uterus..	2 4%	48	3 4.3%	67
6. Operations for hernia, inguinal and femoral, both sexes.....	9 16.4%	46	7 3.8%	175
7. Operations on the kidney and ureter...	3 50%	3	11 13.6%	77
8. Operations in the abdomen not gynæcological.....	23 17.5%	108	55 13.1%	365
9. Operations on chest, abdomenal wall, back and hips.....	0 0%	16	7 5.4%	123
10. Operations on the arm	1 2.3%	43	0 0%	67
11. Operations on the leg and groin	0 0%	91	3 1.5%	197
12. Operations on the head and neck (excluding Nos. 13 and 14).....	1 1.1%	92	7 1.5%	468
13. Operations on the mastoid	4 13.8%	25	1 2.6%	38
14. Operative removal of tonsils and adenoids.....	..	..	..	..*
Totals.....	75 11.94%	553	279 12.38%	1975

*These figures are omitted for the more accurate comparison with the St. Luke's reports, for which this group are incomplete.

A survey of this table indicates that, in spite of the advance in surgical technic, the percentage of patients catheterized remains about the same. There is considerable variation in the individual groups, but as a whole there is little change. There is a notable increase in the time allowed for urination by the surgical service, but any reduction in percentage resulting from this cause is more than offset by the increase in the gynecological service. One of the factors responsible for this, as mentioned previously, is the increased use of the catheter as a diagnostic instrument for the detection and control of residual urine. Strict adherence to a time limit within which every patient must urinate or be catheterized has been the largest factor in this increase.

TABLE X

INFLUENCE OF SEX UPON CATHETERIZATION

Group	Catheterized		Voided		% Catheterized	
	Male	Female	Male	Female	Male	Female
1	0	9	37	24	0	27%
2	1	..	90	..	1.1%	..
3	..	30	..	71	..	29.7
4	..	145	..	176	..	45.2
5	..	3	..	67	..	4.3
6	5	2	159	16	3	11.1
7	7	4	62	15	10.1	22.2
8	13	42	213	152	5.8	21.6
9	1	6	55	68	1.9	8.1
10	0	0	43	24	0	0
11	2	1	135	62	1.4	1.4
12	1	6	238	230	.4	2.5
13	1	0	20	18	5.	0
14	0	0	92	138	0	0
Totals....	31	248	1144	1061	2.64%	18.94%

The peculiar predisposition of women to post-operative bladder disturbance is clearly shown in the table above. The fact that many of the women were under a special routine for post-operative care complicates the picture somewhat when considering the whole series. For example, at least 7 out of the 9 rectal cases that were catheterized were under the gynæcolgoical routine and so far as their operation is concerned might as well have been included in group 3.

The high incidence of catheterization in the groups composed entirely of women is highly suggestive when compared with group 2 in which men only

are concerned. Group 8 is perhaps as representative as any, in that all the patients were under the same service and presumably both sexes were treated alike. The fact remains that from whatever aspect the subject is viewed, women are much more liable to urination difficulties than men.

TABLE XI

INFLUENCE OF SOCIAL STATE UPON CATHETERIZATION—MALES

Age	Catheterized		Voided		% Catheterized	
	Single	Married	Single	Married	Single	Married
12–19	2	0	147	2	1.3%	0
20–29	7	4	218	112	3.1	3.5
30–39	1	2	85	160	1.1	1.2
40–49	0	9	38	191	0	4.5
50–59	1	3	15	116	6.6	2.5
60–69	0	2	5	45	0	4.
70–79	0	0	1	3	0	0
80–	0	0	0	2	0	0
Totals.....	11	20	509	631	2.1%	3.1%
FEMALES						
12–19	9	11	137	13	6.2%	45.8%
20–29	19	57	159	221	10.7	20.5
30–39	6	68	50	227	10.7	23.1
40–49	5	45	13	130	25.	25.7
50–59	1	21	9	68	10.	23.6
60–69	0	4	4	25	0	12.1
70–79	0	1	1	5	0	12.5
80–	0	0	0	0	0	0
Totals.....	40	207	373	689	9.7%	23.1%

The influence of marriage upon catheterization is apparently very slight in the case of men, but much more definite in women. Undoubtedly the influence of age in this tabulation cannot be safely disregarded, but in the groups of earlier decades the contrast between the figures for married and single is quite definite.

The influence of sexual activity upon the functional control of the bladder has been mentioned in a previous paper. In that series the patients were for the most part under direct observation, hence an opinion in this matter could be expressed with more confidence. Those listed as married are not all those

in whom libido is a dominant passion, and conversely those who are single are not necessarily to be considered as devoid of it nor lacking in the opportunities to gratify it. However, it appears that a strong sexual instinct, a more or less unstable nervous temperament and bladder difficulties after operation are very commonly associated.

The marked frequency of catheterization in women during and after the child-bearing age is undoubtedly due to the alterations in organs incident to pregnancy and the frequent complications and sequellæ thereto.

THE INFLUENCE OF RACE UPON CATHETERIZATION

All patients were classified as to race into two groups, white and colored. The latter includes all negroes and those with any admixture of negro blood; the white race includes all others. There are relatively few Jews in the series as they are, for the most part, cared for in their own hospital nearby. Almost every other race is represented except those from the Orient.

Among the catheterized patients 210 were white and 68 colored, and among the patients that voided 1713 were white and 492 colored. The percentage of whites catheterized was 10.9 per cent. and of the colored 12.1 per cent. In 7 out of 14 groups there were no catheterized colored patients, while the whites were represented in all groups except 2. Fifty-three out of the 68 catheterized negroes were found in group 4, the remaining 13 being scattered. The 68 reports of catheterization are all from women, not a single male negro being catheterized.

The relative immunity of negro men from disturbances of bladder function agrees closely with the deductions as to the important factors, particularly those referring to temperament. As a rule the colored race, at least those that ordinarily reach the hospital from the out-patient department, are phlegmatic, easy-going and without ambition or "nerves" in the usual sense of the word. Their sensibilities are low and to that extent they appear to endure ordinary pain in much the same way that Koreans do. However, their fortitude is somewhat lacking, for they easily become panicky and lose control of themselves. Particularly is this true of the women. The difficulties experienced by nurses in the control of these women after serious operation are sometimes very great.

On the basis of a much longer experience with these patients than is covered by this review, Casler feels that colored women do not have to be catheterized as frequently as white women. It has been his impression that there were few neurotic individuals in the colored wards and that any deductions drawn from these figures would, therefore, not be correct as regards colored women. He feels equally certain that the proportion of Jewish women that have to be catheterized is much higher than the Gentiles.¶

The capacity of the normal bladder has been studied by physiologists and surgeons with results somewhat at variance. Physiologists usually state that the detrusor muscles begin more decided contractions when the content of

¶ Personal communication from Dr. D. B. Casler.

the bladder reaches about 250 c.c. and the intravesical pressure is 150 mm. of water.

Hunner and Lyon[3] tested the capacity of a small series of female patients using distention with air and with fluid. With air the capacity averaged about 300 c.c., and with fluids a little more than 400 c.c. Under anæsthesia the capacity was somewhat greater than when the patients were conscious. The bladder walls of nulliparous women were apparently more elastic and capable of painless distention than those of parous women, a condition thought to be due to sclerotic changes in the latter following or incident to pregnancy and labor.

Study of the graphs of the amounts of urine obtained by urination and catheterization shows that the greatest number of specimens obtained by either method lies between 300 and 349 c.c. Of the voided specimens 1351, or 77.2 per cent., were below 400 c.c. in amount and of the catheterized specimens 372, or 57.2 per cent., did not exceed that figure. These are well within the generally accepted limits of distensibility and the presence of these amounts certainly had no deleterious effect upon the bladder walls. In chronically distended bladders the presence of a much greater amount would probably not add to the injury already done, and more urine would be needed to initiate the reflex mechanism.

Taussig[4] has summarized the results of catheterization in a series of gynecological cases, excluding dilatation and curettage, and finds that 23.2 per cent. were catheterized. Our series for the same group gives 41.5 per cent., although he does not state the exact conditions under which the catheter was used. He also tabulates 311 cases which voided. Evidently no definite time limit was set within which urination or catheterization must take place, as there is given a summary by hours within which urination took place. These include various periods, the highest being 20 hours or more. The greatest number of cases, 94, voided between 10 and 12 hours, the largest being 82, between 7 and 9 hours. These periods are distinctly longer for the maximum number and the nearest one to it, being for our series 6 and 8 hours respectively. In Taussig's series 180 c.c. was the amount voided by the greatest number of patients, and only 5.8 per cent. exceeded 360 c.c.

The following table gives the amounts of urine passed both by voiding and by catheter according to the interval that elapsed after operation.

It would be impossible to estimate exactly the hourly excretion of the kidneys in each case, owing to the varying amounts that the bladder contained at the completion of the operation. This could have been determined with exactness only by routine catheterization at this time and the recording of the exact time of emptying the bladder and the amount it contained. The value of these figures is, therefore, greatly decreased, but they are sufficiently accurate to enable us to make comparison between the voided and catheterized specimens and to cause us to realize clearly that recovery from the effects of operation varies within wide limits so far as kidney secretion is concerned. This emphasizes the desirability of treating each patient as an individual

TABLE XII

Catheterized Specimens						Voided Specimens				
Interval in Hours	No. of Reports	Minimum in c.c.	Maximum in c.c.	Average in c.c.	St. Luke's	No. of Reports	Minimum in c.c.	Maximum in c.c.	Average in c.c.	St. Luke's
½	...	...	....	...	...	1	200	200	200	...
1	1	400	400	400	...	10	130	500	230	...
1½	...	...	....	...	...	5	50	500	300	...
2	8	85	1000	470	...	33	10	500	223	120
2½	...	...	....	...	...	6	25	375	241	...
3	6	60	425	219	...	72	10	725	258	180
3½	...	...	....	...	...	5	50	300	190	390
4	6	60	650	319	...	110	30	650	252	214
4½	...	...	....	...	...	12	50	410	222	360
5	6	90	700	272	...	149	15	600	255	160
5½	...	...	....	...	...	17	25	500	220	160
6	24	50	700	356	...	214	15	800	249	264
6½	...	...	....	...	...	29	100	700	261	230
7	18	75	800	417	...	176	5	750	234	203
7½	...	...	....	...	360	19	100	650	314	150
8	40	25	800	325	...	192	25	500	260	285
8½	...	...	....	...	240	18	20	600	312	257
9	37	125	800	487	360	155	25	900	265	200
9½	...	...	....	...	300	16	25	500	252	240
10	46	30	880	382	202	144	40	925	278	260
11	58	25	850	372	360	134	20	950	295	258
12	276	10	1150	399	442	126	25	750	311	212
13	35	200	700	375	480	59	25	800	301	240
14	21	225	1000	488	420	55	25	700	318	240
15	9	150	1175	548	390	53	10	650	268	...
16	13	200	875	446	480	46	100	810	368	...
17	9	300	1000	586	450	45	40	800	358	...
18	2	500	850	675	...	43	15	750	323	240
19	...	...	....	...	...	28	30	500	369	...
20	4	625	750	719	...	24	40	850	389	...
21	5	150	700	435	...	23	20	1 100	388	...

TABLE XII—CONTINUED

Catheterized Specimens						Voided Specimens				
Interval in Hours	No. of Reports	Minimum in c.c.	Maximum in c.c.	Average in c.c.	St. Luke's	No. of Reports	Minimum in c.c.	Maximum in c.c.	Average in c.c.	St. Luke's
22	5	250	800	495	...	16	100	750	324	...
23	4	100	700	487	...	18	75	1000	378	...
24	4	25	1350	567	...	13	175	650	423	300
25	5	200	425	340	...	16	50	1675	369	...
26	2	600	900	750	...	6	250	600	458	...
27	1	325	325	325	...	3	150	500	263	...
28	1	850	850	850	...	4	200	1750	645	...
29	...	...	....	...	...	2	300	650	475	...
30	1	650	650	650	...	2	330	630	490	...
31	1	400	400	400	...	....	...	....	...	...
32	1	750	750	750	...	1	525	525	525	...
33	...	...	....	...	...	1	150	150	150	...
Totals.	649	10	1350	407 c.c.	...	2001	5	1750	286 c.c.	...

rather than in the aggregate, as would be the case where specific rules are laid down for their catheterization.

The general average for catheterized specimens is, as would be expected, materially higher than for voided specimens. That this is no accident is shown by the fact that hour by hour the figures are higher. As compared with the St. Luke's figures, a surprising number of cases were catheterized after very short intervals following operation. In some instances the records show that these followed shortly after a urination at which only a small amount of urine was passed. These, doubtless, have been for diagnostic purposes to detect a possible residual urine that was not previously suspected. If so, this would seem to be a logical procedure. The column indicating the maximum amounts for each time interval is instructive as showing how early a large amount of urine may be present in the bladder. The routine for emptying the bladder before operation is not sufficiently specific except on the gynæcological service, so that even several hours might intervene between that act and the conclusion of the operation. Some of these instances where large amounts of urine were found in the bladder a short time after operation might have been produced in this way. This places the house officers at a distinct disadvantage when diagnosing the cause of pelvic pain and complaints of distention, especially when dealing with those patients whose charts were commenced at the time they were taken to the operating room. Many charts gave no record whatever of any pre-operative urination.

The record of voided specimens is instructive in indicating a combination of the rapidity of urinary excretion and the effect upon it of more or less retention. It is safe to assume that practically every operated patient has more or less impairment of his urinary function, the question of catheterization being dependent upon the speed of its recovery and the time which the

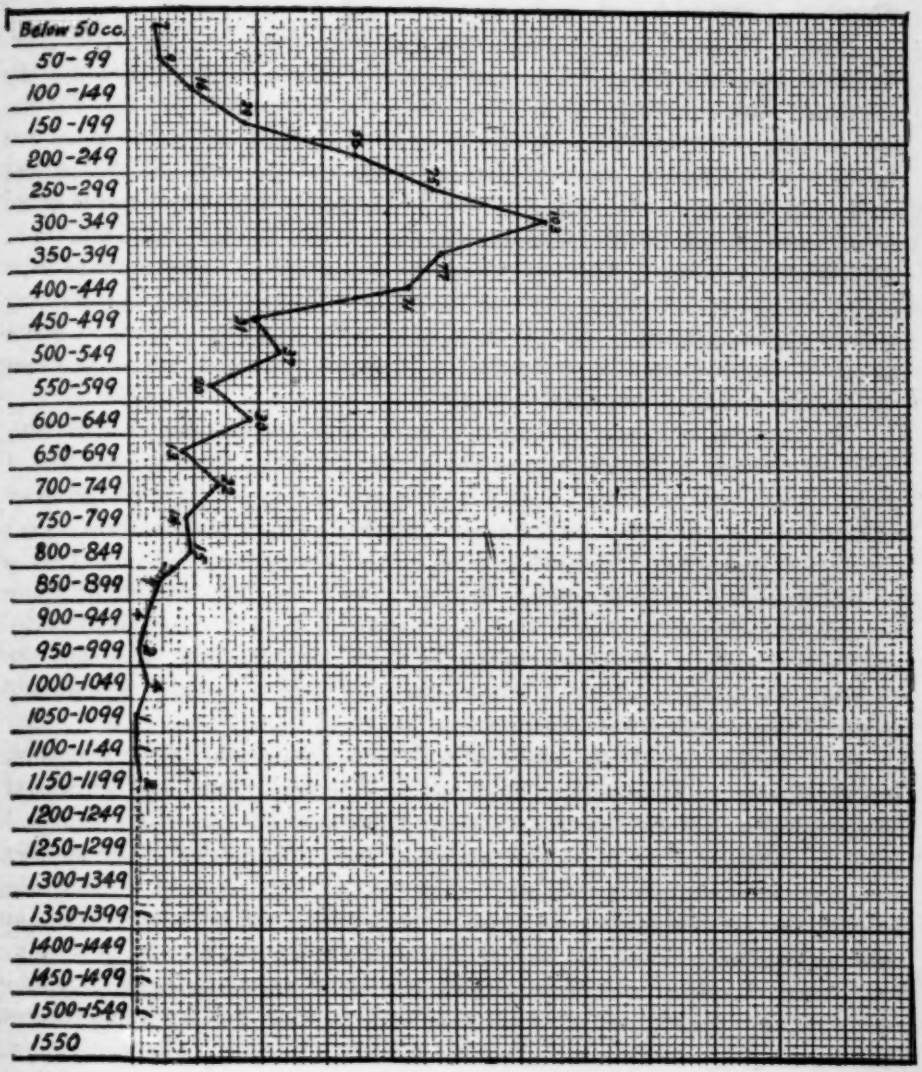

FIG. 1.—Record of voided specimens.

operator is willing to wait for urination to take place. Unfortunately we have no exact information by which to determine whether a bladder wall is really injured by allowing the viscus to fill to a degree quite above that to which it is accustomed. If a bladder which had previously completely emptied itself at each urination were found after such a distention to be unable to do

so, it seems logical to conclude that it had been injured by that distention. Search through the literature fails to find any such systematic search for the presence of vesical insufficiency or investigation of the mechanism by which it is produced. It would seem in the light of our knowledge of the dangers arising from the presence of residual urine that the use of the catheter for diagnostic purposes before operation would be fully justifiable.

Doctor Hunter § states that, "the hospital which has the least post-operative bladder trouble of any institution with which I am acquainted is the Frederick City Hospital. Here Miss Nies, the Superintendent, has for the past twenty years taught her nurses to go to abdominal and pelvic cases five hours after operation, carrying the bed pan, and insisting on the patient voiding at that time. With this display of assurance that the patient is going to void and getting them at a time when the bladder has not had a chance to over-fill, the procedure is almost invariably successful and they do very little post-operative catheterization in that hospital." This illustrates in a striking manner the importance of nervous inhibition in the majority of patients and a means by which it may be overcome. It does not, however, assure one that the bladder has been completely emptied.

The frequency of post-operative urinary retention has not been investigated as fully as its importance would justify. Curtis,[5] in a large series of major operations on women, found a close connection between the presence of residual urine and the bladder symptoms that led to catheterization. Less than 1 per cent. of the patients who were not catheterized for vesical signs of retention had residual urine, whereas more than 64 per cent. of those repeatedly catheterized had a residuum of more than 1 oz. The bladder condition usually returned to normal in from four to eight days, but the recovery was greatly delayed by the presence of infection which was limited to the bladder in all but a few cases.

In a previous article the advantages of crowding fluids before operation was emphasized. An abundant supply of fluid is thus provided which should compensate in part for operative loss of blood and produce a physiological polyuria with the more rapid elimination of metabolic wastes. The bladder would fill somewhat more quickly and in case urination was possible would irrigate the urethra earlier and more frequently. Baisch [6] found that in patients (women) confined to bed and allowed to urinate only twice in twenty-four hours, B. coli could be invariably cultivated from the urethra within five days. The multiplication of urethral bacteria was inhibited by increasing the frequency of urination and the total quantity of urine. The histories of these patients did not indicate that the crowding of water had been a routine, but there is abundant evidence that fluids were allowed much more freely than during the period of observation of the St. Luke's series.

Notations of "thirsty" on the charts were unusual, the notable exception being the catheterized mastoid patient who for some unstated reason was denied fluids for many hours after operation. Early giving of water after

§ Personal Communication.

operation, even though it is vomited, is an advantage as it washes out the stomach and hastens the disappearance of nausea.

The literature contains many suggestions as to methods of combating post-operative retention, some of which were found to have been of benefit.

The effect of gravity in the initiation of urination and in the production of residual urine has not been sufficiently emphasized. Barringer and Mackee [7] found with the X-ray that the bladder is funnel-shaped with the apex corresponding to the urethra. A bismuth suspension had been injected into the bladder for diagnostic purposes and they discovered that they were unable to wash it out as long as the patient was reclining, but could do so readily when he was in the sitting position. This observation suggests the mechanism that undoubtedly assists in the production of residual urine in an atonic bladder. Several of the cases in our series show a wide variation in the amounts recovered by catheter at regular intervals, indicating clearly that the catheter is not to be relied upon to completely empty the bladder. This would be particularly true where a chronically distended bladder formed a pouch on either side of a recently suspended uterus. Nothing short of raising a person in bed until the urethra formed the lowest point would ensure complete emptying of the bladder.

The part played by the act of catheterization in the etiology of post-operative cystitis has been generally misunderstood. In the Wertheim [10] operation for cancer of the uterus, involving as it does extensive dissection of the bladder wall, cystitis has been a frequent and serious complication. It occurred in cases that were not catheterized as well as in those that were. In an effort to decrease the incidence of this complication, Wertheim used special care in the aseptic technic of catheterization, but without appreciably influencing the results. He concluded that the presence of residual urine was the most important factor, a condition made possible by the paretic state of the bladder walls, thus permitting the continued development of bacteria.

Albeck [11] reported the results of an examination of 250 gynæcological cases, of which number 130 had residual urine and 120 did not. Of the former group 12 had pyuria, 52 bacilluria and the urine of 12 more contained an occasional organism. Only 16 of the latter group of 120 cases had urine containing bacteria, the remaining 104 being sterile. In these cases no urinary obstruction was present, the walls of the bladder being weakened by age, tumors, or displacements. Thirty-two of these patients were old women, all of whom had residual urine; 11 had pyuria and 13 bacilluria.

In the entire series no record was found of any cystoscopic examination of the bladder to determine the presence or absence of post-operative bladder changes. Presumably the results would have been in agreement with those of Kolischer [8] who found a "mild desquamative catarrh" quite frequently, especially about the trigone and ureteral openings. He saw no evidence that the actual passage of a catheter had injured the mucosa of the bladder, either at the vesical orifice or on the opposite side where the tip might impinge. Most writers agree that the bladder injury, of whatever extent, is directly

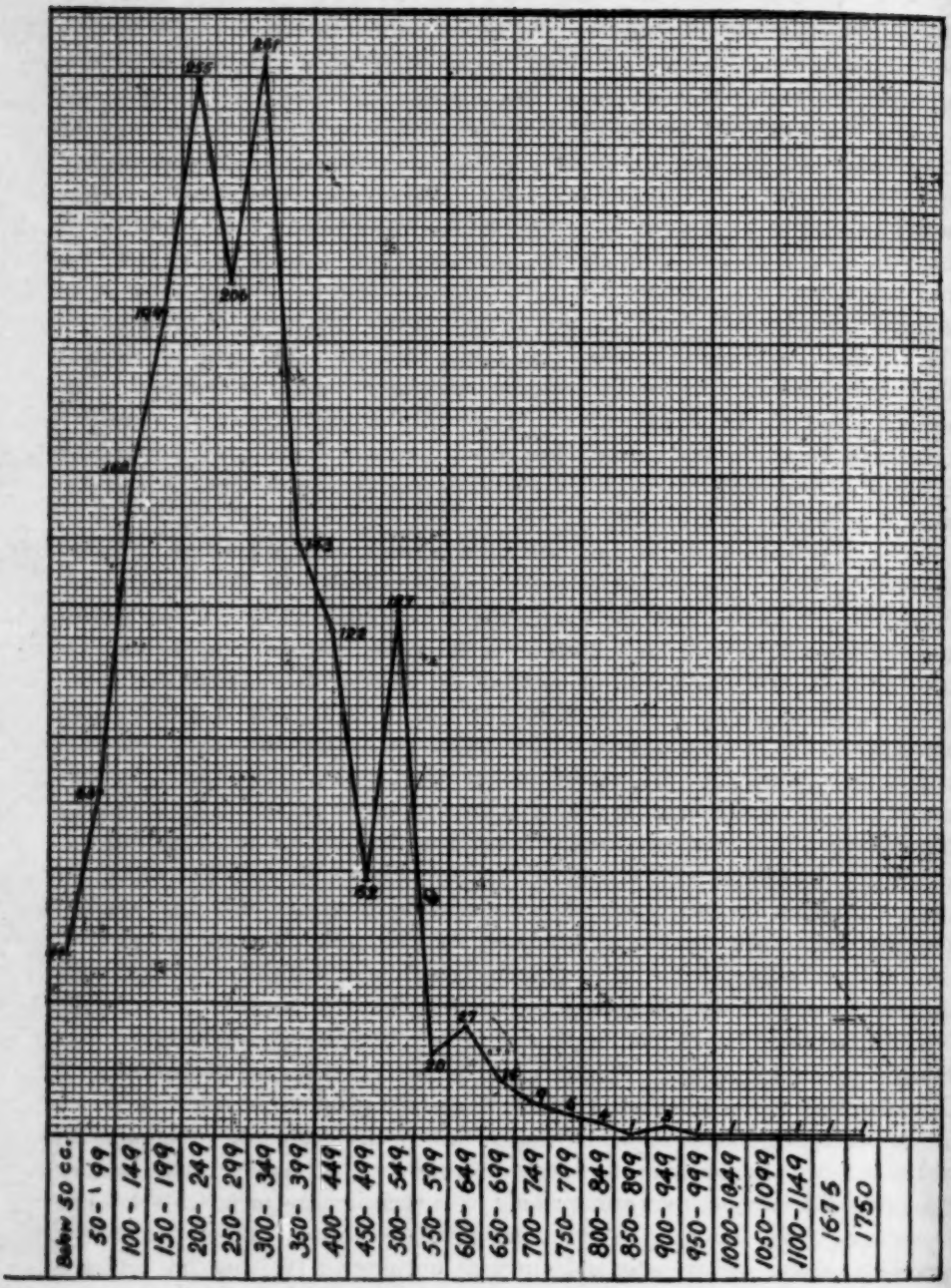

FIG. 2.—Record of voided specimens.

attributable to influences from without, either trauma to the walls or interference with the blood and nerve supply, or both, the bladder changes being directly proportional to the extent of the injury and the rapidity of recovery therefrom. General appreciation of these facts has, however, led to alterations in surgical technic whereby unnecessary injury to the bladder wall and adjacent pelvic viscera has been eliminated.

In many instances the records show that catheterization followed shortly after voluntary urination and in some instances several hours after operation, with the recovery of relatively large amounts of urine. In the St. Luke's series the catheter was apparently not used for the diagnosis of residual urine, whereas in the present series it was frequently employed for that purpose. In some instances catheterization and urination alternated in an irregular manner, perhaps for days, until the patient had apparently regained control of the bladder function. This often coincided with the time when the patient was allowed to sit up or get out of bed. This coincidence has been noted by several observers and has led some to urge their patients to sit up much earlier than they might be inclined to do. Jansen [9] observed that cystitis was less frequent among patients who got out of bed early than those who were longer confined.

The conditions under which bacteria can multiply in the bladder are not fully understood. Kolischer asserts that, with the exception of the gonococcus and diphtheria bacillus, the various pathogenic bacteria do not produce cystitis unless the bladder wall has been previously injured. This may vary all the way from a mild desquamative catarrh to a traumatic cystitis or actual necrosis. These are the physical expression of a functional alteration in the muscular power of the bladder which results in an incomplete emptying of that viscus. Residual urine appearing after operation is usually an indication that the walls of the bladder are so altered that the development of cystitis is imminent. Curtis [12] considers the diagnosis of impaired bladder function of great importance and uses the catheter freely to determine this point. He also follows each voluntary urination by catheterization until complete bladder function has been restored, as shown by the fact that not more than 20 c.c. of urine can be thus recovered. Copious bladder lavage is employed after each catheterization. Pre-operative examination included a similar test of bladder function.

In the present series of cases there appeared to be a definite effort to ascertain the degree of functional control by means of the catheter, but there was no such systematic control of the situation exercised as advocated by Curtis. The irregularity of catheterization after operation also suggested that the pre-operative bladder function had not been tested, at least in many cases.

In very few instances was the use of the catheter continued after the patient was able to void even relatively small amounts of urine. There was thus no way of knowing whether or not a state of residual urine existed. Taussig says, "the danger of infection lies less in the technic or frequency of catheterization than in the presence of urine stagnation in the bladder."

"Some of my most serious infections occurred in women in whom I had ceased prophylactic measures as soon as they began to void spontaneously." Apparently in the present series of cases very few had any form of local bladder treatment after they were able to void, although urotropin was perhaps continued for a longer period. Curtis says, "observance of rigid asepsis seemingly exerts only moderate influence in diminishing the number of such infections." "Another curious fact is that patients catheterized by well-trained nurses suffer from cystitis, while urologists continue to pass catheters and cystoscopes with impunity." Apparently the secret of this paradox is that residual urine is much more frequent in women than in men and that the urethra being short and wide allows bacteria to develop much more freely on its mucosa.

Curtis studied catheterization in a fairly large series of gynæcological cases. Nearly all of those catheterized several or more times yielded residual urine when tested with the catheter after normal micturition had been resumed. This gradually decreased in amount and was usually absent in a week. He remarks, "It would seem that no course of procedure is more pernicious than that of the regular use of the catheter over many days followed by abrupt cessation of all catheterization on the assumption that as soon as the patient begins to void the power of thorough evacuation has returned." "Some cases in the series not so closely observed, when tested for residual urine, showed pus in the urine and evidences of cystitis."

He complains of the difficulty of enforcing the rule to catheterize after voiding because of the fear on the part of the nurses of producing a cystitis. It would seem that the matter of the routine use of the catheter has been entrusted to nurses too long and that the indications for its use should revert to the house officers who alone are in position to apply it scientifically and for a definite purpose. A nurse should not be expected to differentiate distention from a full bladder from that due to other causes, nor should she be expected to use the catheter for diagnostic purposes. The actual technic of catheterization of female patients may still remain where it is, but the most skilfully devised routine cannot hope to treat successfully all the varying situations in which the use of the catheter is indicated.

Ideal conditions, such as these, are at present difficult to create in most hospitals where rotating interne services bring relatively inexperienced men into immediate charge of post-operative patients. This should, however, be considered the goal toward which special efforts may be directed.

SUMMARY

1. The post-operative histories of 2254 patients are here summarized, of which 279, or 12.38 per cent., were catheterized. These were largely from the gynæcological and surgical services, the former being subject to definite rules as to the time allowed for urination, the latter being governed by individual orders issued by the house staff.

2. Comparison with a previous series indicates great advance in surgical

technic, but no decrease in the percentage of patients catheterized. The frequency with which the catheter was used for diagnostic purposes has greatly increased.

3. The body has been arbitrarily divided into regions and the operations have been grouped and compared. Urinary retention appears to be most frequent in those groups involving the pelvic structures and to decrease in frequency as that region is departed from.

4. Urinary retention is favored by shock and consequent low blood-pressure with decreased output of concentrated urine, by pain, nausea and vomiting, plugs, packing and other mechanical factors, causing perineal pressure and by the presence of a neurotic temperament, having some relation to race and sexual activity. Such difficulty before puberty was not observed.

5. A distinct advance is noted in the freedom with which patients are allowed fluids both before and after operation, as compared with a decade ago.

6. In most cases urination will occur when sufficient fluid has accumulated in the bladder, even though the amount may exceed somewhat the usual content of the viscus. Danger of rupture in the absence of pain is negligible within the first twenty-four hours and the use of palpation and percussion will prevent abnormal distention in most cases. The rate of urine accumulation after operation varies within wide limits; when coupled with uncertainty as to urination *just* before operation and the great difference in the length of operations, any rules for catheterization based upon the time after a patient returns to the ward are open to serious question. The consideration of patients as individuals subject to individual orders rather than in groups would appear to be more logical and lead to less injury from a possible distention of the bladder than when catheterization is left too much to the discretion of the nurses. The actual catheterization of female patients may still be done by nurses, but the responsibility for ordering it should be entirely in the hands of the house staff.

8. The act of urination in bed can be made much easier in many cases by accustoming the patient to the use of the bed pan before operation, by placing the patient in as comfortable a position as possible, free from strain on any set of muscles, particularly those of the perineum, by allowing as much freedom of motion in bed as the operation will permit and by raising the patient as near the vertical position as possible.

9. Women are much more liable to bladder disturbances than men, a condition for which a relaxed perineum is often responsible. Chronic vesical distention with insufficiency frequently follows and is usually indicated by cystocele. Retention in parous women is aften due to degenerative changes in the bladder wall, while that in nulliparous women is frequently of neurotic origin.

10. Marriage had no noticeable effect upon catheterization in men, but is clearly of importance in women. The percentage of catheterization of married women was more than twice as high as for single women. The difference was especially noticeable in the women married very young, and became less

marked in the decades following. It appears that a strong sexual instinct, a more or less unstable nervous temperament and bladder difficulties after operation are commonly associated.

11. The white race was probably more liable to urinary difficulties after operation than the colored. The latter seemingly bear moderate pain quite well, but lose control of themselves in emergencies or in severe pain. Colored women whose operations involved the pelvic or abdominal organs were frequently catheterized, but the catheter was not used on a single colored man.

12. Laparotomy and the technic that goes with it was responsible for retention in many female patients, the addition of minor operations on the peritoneum, such as removal of the appendix, having little influence in raising the incidence.

13. In the group comprising operations on the abdominal organs, four times as many women were catheterized as men. Operations on the pelvic organs of women caused retention to a still greater degree.

14. The pressure on the bladder in suspension of the uterus is not ordinarily sufficient to disturb its function unless associated with other operations that compromise its blood or nerve supply.

15. Nervousness in hyperthyroidism was responsible for several cases of retention, but was far less potent in its effect than when associated with pelvic conditions.

16. The importance of residual urine as a predisposing factor in cystitis is being more generally recognized and there were definite evidences that the catheter was used for its detection when the patient voided small amounts of urine.

17. The use of the catheter is indicated before operation for the diagnosis of possible residual urine or to facilitate the procedure, and after operation for the same purpose following the first voluntary urination. If residual urine is found, catheterization should be continued as long as it is present. In such an event, treatment for an anticipated cystitis should be instituted immediately the diagnosis is made.

18. Physicians and nurses should consider that the function of the catheter in post-operative conscious patients within the first twenty-four hours may be the relief of pain due to an accumulation of any amount of urine in the bladder, and is not for for the mere mechanical withdrawal of that fluid to prevent a possible overdistention or rupture of that organ except where bladder changes are known to exist or under conditions of pelvic abnormality in women where they are suspected. There is no evidence that a normal bladder distended beyond the ordinary limits is injured thereby and will not immediately return to its former condition after functional control has been restored.

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CONCLUSIONS BASED ON A STUDY OF FOUR THOUSAND CASES OF GOITRE

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The material on which the conclusions in this paper are based consists of four thousand surgical and non-surgical cases of goitre which I have observed during the past five years at the Jackson Clinic, and as a Fellow in Goitre Surgery at the Mayo Clinic. Although these observations are for the most part not new, they are culled from a great mass of facts and for the first time formulated in brief statements.

Advanced cases of exophthalmic goitre are at times treated as endocarditis by heart specialists, as nervous dyspepsia by gastro-enterologists, and as neurosis by neurologists. Little discrimination is made between cases of adenoma of the thyroid with hyperthyroidism and exophthalmic goitre. They are all too generally called "toxic goitre."

The study of goitre is complex, and much confusion exists over the diagnosis and treatment of the various forms. To bring order out of this chaos of opinion, a simple classification is essential, for example: 1. Colloid goitre. 2. Adenoma: (*a*) With hyperthyroidism (toxic adenoma); (*b*) without hyperthyroidism (simple adenoma). 3. Exophthalmic goitre (Basedow's or Graves' disease). 4. Tuberculosis, malignancy, syphilis, thyroiditis, actinomycosis, and so forth. The usual text-book classification of goitre is confusing. The various clinical types of cystic, calcareous, and hemorrhagic goitre are merely degenerative forms of adenoma.

Colloid Goitre.—Colloid goitres appearing at puberty are seen in 60 per cent. of girls between the ages of sixteen and twenty in the goitre district of the Middle West.

Factors in the etiology of colloid goitres are: A deficiency of iodine in the soil and consequently in the drinking water; an excessive demand upon the thyroid gland for thyroxin by the muscular, osseous, and especially the reproductive systems at puberty; an undue mental and physical strain imposed upon the thyroid by modern scholastic requirements and social obligations.

The ordinary colloid goitre with its soft globular feel and symmetrical enlargement is easily diagnosed. The vascular type with thrills and bruits, pseudo-exophthalmos, tachycardia, and nervousness must be differentiated from exophthalmic goitre by the absence of true exophthalmos, quadriceps loss, or severe loss in weight. A normal basal metabolic rate confirms the diagnosis of colloid goitre.

In the treatment of colloid goitre, three common mistakes are: 1. The diagnosis is too long delayed and treatment is begun too late. 2. There is no

uniformity in the method of treatment. 3. Treatment is continued in spite of the development of large adenomas. Colloid goitre may be prevented by administering 10 mg. of sodium iodide once a week during the school year, as proved by Marine and Kimball. The treatment of colloid goitre should be begun early, since adenomas tend to develop between the ages of sixteen and twenty. The vascular type of colloid goitre responds most favorably to thyroid extract or thyroxin. Iodine gives better results in the ordinary type. Apparently adenomas develop in neglected colloid goitres as a form of compensatory development. Consequently, the incidence of adenoma of the thyroid is decreased by the prophylactic treatment of colloid goitre.

Adenomas of the Thyroid.—Adenomas rarely cause symptoms of hyperthyroidism before the age of twenty-five, unless provoked by iodine medication. One in every four adenomas becomes toxic before the patient reaches fifty years of age. One in every five adenomas develops a substernal projection. Five women have adenomatous thyroids to every man that has one. An adenoma is present an average of sixteen years before the onset of toxic symptoms.

The onset of toxic symptoms is both more gradual and insidious in adenoma than in exophthalmic goitre. Toxic symptoms exist an average of four years before the patient with an adenomatous goitre consults a surgeon. The slowly progressive hyperthyroidism of an adenoma causes permanent and serious damage to the heart and kidneys. Myocardial degeneration, as evidenced by irregularities in heart rhythm and œdema of the ankles, is of frequent occurrence.

The popular interest which has been aroused in the treatment of goitre by iodine has greatly increased the number of cases of iodine hyperthyroidism. Iodine is a specific in the prevention and cure of colloid goitre of adolescence, providing no adenomas are present. If in doubt of the presence of an adenoma of the thyroid, do not give iodine. Thyroidectomy is indicated in the majority of patients more than twenty-three years of age with adenomas of the thyroid. In adenoma of the thyroid the gland is asymmetrically enlarged, and one or more nodular tumors may be palpated. In exophthalmic goitre the gland is symmetrically enlarged.

In toxic adenoma acute crises do not occur. Thrills and bruits are rare. Exophthalmos is not seen. The average age of the patient is forty-four years. Hypertension and a disproportionately high diastolic pressure is the rule. The basal metabolic rate averages +38 per cent. Loss in weight and strength, tremor, nervousness, a moist skin, tachycardia, and palpitation occur as in exophthalmic goitre.

Intrathoracic and Substernal Goitre.—An intrathoracic goitre is one in which the greater part of the enlargement of the thyroid is situated within the thorax. A substernal goitre is one in which there is a projection of only part of the thyroid into the chest. An exophthalmic goitre is never totally

intrathoracic. A history of a gradually disappearing goitre, chronic cough, choking spells, difficulty in swallowing, and increasing huskiness of the voice is indicative of a substernal or intrathoracic goitre. One patient in every four has toxic symptoms. Dilated veins on the chest occur in 10 per cent. of the cases.

Carcinoma of the Thyroid.—In one series of 100 patients with goitre, observed at the Jackson Clinic during 1923, there were four cases of carcinoma. Three of the patients are now dead. The mortality in clinically diagnosed cases of malignancy of the thyroid is 100 per cent. Is there any justification for delaying operation until a clinical diagnosis of malignancy or myocarditis can be made in adenoma of the thyroid? Malignancy does not occur in cases of exophthalmic goitre. An adenoma is a neoplasm; it is potentially a precursor of cancer and should be removed no matter in what part of the body it is located.

Exophthalmic Goitre.—Unlike toxic adenoma, the onset of hyperthyroidism in exophthalmic goitre is acute, the average duration of symptoms being nine months. The disease is more common in youth, the average age being twenty-six years, but it may also affect children or the aged. Exophthalmic goitre progresses by acute exacerbations and periods of remission. At the crests of the waves of hyperthyroidism all symptoms are intensified and gastro-intestinal crises occur. Thrills and bruits occur in 80 per cent. of the cases. Bilateral exophthalmos is observed in one of every two patients within three months of onset of symptoms.

The pulse pressure is high, a low diastolic pressure being a very important diagnostic point. Loss in weight, in some cases rapid and extreme, is accompanied by a variable and at times excessive appetite. Muscular asthenia is most marked in the quadriceps group of muscles. The basal metabolic rate is not an index of the patient's ability to undergo operation, but as a diagnostic aid and a post-operative proof of the result it is invaluable. The average basal metabolic rate is +54 per cent. Contrary to a generally accepted view, fever is present only during a crisis, hence there should be no difficulty in eliminating the diagnosis of tuberculosis.

Pre-operative Measures.—An examination of the vocal cords should be made in every case of adenoma of the thyroid. Laryngeal examination will show partial or complete paralysis of one or both cords in one in every fifteen cases. This evidence may prove important from a medico-legal standpoint post-operatively. If one cord is paralyzed before operation, especial care must be taken not to injure the nerve supply of the other cord. A Röntgen-ray examination of the chest is of value in eliminating substernal or intrathoracic goitres. The two most important pre-operative measures are the choice and the time of operation. A severe recent loss in weight and strength with a rapidly rising metabolic rate warns of an approaching crisis. If possible, operation should be performed during a remission or early in the

course of the disease when the weight is stationary or increasing. Two cubic centimetres of tincture of digitalis is given to all patients three times a day for three days as a minimum. As patients grow weak from lying in bed, they should be allowed to be up from one to three hours daily. Thirty grains of bromides daily quiets patients with toxic goitres. A diet of 4000 calories a day is required as a minimum to maintain body weight.

In exophthalmic goitre Lugol's solution reduces the metabolic rate an average of 20 per cent. pre-operatively. There is a proportionate clinical improvement, and the necessity for ligation is obviated in 75 per cent. of the cases. Lugol's solution and ligation are not indicated in the treatment of toxic adenoma. I give two hypodermics before all operations, gr. ¼ of morphine, followed in fifteen minutes by gr. 1/300 of scopolamin.

Anæsthesia.—Because of the numerous advantages of the novocain method of local anæsthesia, I use it in 90 per cent. of cases. The operator and his assistants must handle the tissues most gently and carefully to minimize the sensation of pain and pressure. Any trauma or injury to the recurrent laryngeal nerve may at once be detected by talking with the patient. When the operation is finished, undetected bleeders may be found by causing the patient to cough and strain. The disagreeable post-operative nausea and vomiting following ether narcosis are eliminated. The risk of post-operative hyperthyroidism is diminished. There is a decreased chance of post-operative aspiration pneumonia, although pneumonia may occur. The operator can tell whether the patient's condition warrants continuing the operation. The disadvantages of novocain anæsthesia are: Increased strain on the surgeon; increased psychic disturbance to the patient; increased time required for operating.

Operation.—Team work rather than individual brilliancy on the part of the surgeon favors a rapid, bloodless resection of the thyroid gland. Time may be gained by preventing hemorrhage from the small vessels in dissecting up the skin and platysma, by applying a very sharp scalpel edgewise and not too deep, while strong traction is exerted by assistants on either side of the flap.

Opinions differ on the necessity of dividing the sternohyoid and sternothyroid muscles. Unquestionably it gives better exposure, and whenever this is required as in the case of a vascular, friable exophthalmic goitre or a large colloid adenoma, there should be no hesitation about dividing the muscles. Early exposure and anæsthetizing of the upper poles, followed by double clamping and dividing, permits better mobilization of the gland, reduces the factors of shock and pain, and decreases hemorrhage. Having properly exposed the goitre by dissecting with the scalpel along the plane of cleavage, one should ligate the lateral veins in order that these vessels may not be torn away and retracted into the wound. The recurrent laryngeal nerve must be avoided by placing clamps parallel and not at right angles to it. Only the edges of the capsule or the surfaces of the gland are sutured.

Post-operative Care.—Post-operatively patients must be kept under the influence of morphine for from twenty-four to forty-eight hours, depending on the degree of toxicity. Fluid intake must be kept up to 3500 c.c. Digitalin, gr. 1/25 hypodermically, may be given every hour if indicated.

Eighty-five per cent. of the cases of toxic goitre are cured by surgery. Medical measures may temporarily benefit but only delay the relief possible to obtain by surgery. Röntgen-ray and radium are contra-indicated in the treatment of any type of goitre except exophthalmic goitre. In these cases treatment must be continued over a long period of time and with only uncertain results.

SUBDIAPHRAGMATIC ABSCESS AND ACCUMULATIONS OF FLUID*

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Anatomical conditions in the subphrenic area situated below the dome of the diaphragm make the presence of accumulations of pus or fluid in this region difficult to diagnose, and even after the diagnosis has been made, present several problems of treatment. This is particularly true of lesions on the right side, where the pathological condition most frequently occurs.

Anatomy.—The ligaments of the liver which are only folds of peritoneum reflected from the liver surface to the diaphragm, divide the subphrenic area into five spaces. The falciform or broad ligament into a right and left area, and the coronary ligament into an anterior and posterior area, while the space between the reflections of the coronary ligaments over the posterior border of the liver forms a smaller extra-peritoneal area. Lymphatic exudate with the resultant development of adhesions along the anterior border of the liver or at other places, determine, with the etiological factor causing the infection, the location of the abscess or fluid accumulation. The left posterior area forms the lesser peritoneal sac. For all practical purposes this would appear to be a sufficient division of these areas, although Knather distinguishes a right upper anterior and posterior, a right lower, and a left upper and lower anterior and posterior space. He says, however, that in the majority of cases pus will be found in more than one of these spaces.

Etiology.—Subphrenic abscess may occur as a pre-operative or a post-operative lesion, usually secondary to a perforative or infectious lesion of one of the abdominal viscera. By far the most frequent causes are appendicitis or perforation of a duodenal or gastric ulcer. Less commonly the gall-bladder, liver, biliary ducts, pancreas, kidney, colon, a residual peritoneal infection of hæmatogenous origin as reported by Eliot, an abscess of actinomycotic origin (Case VI,) the ribs, or even a previous lesion above the diaphragm, may act as the exciting cause.

Pathology.—The pathological condition developing will depend on the exciting cause. As most of the infectious visceral lesions occur on the right side, the abscess or collection of fluid is most frequently found under the right vault of the diaphragm. An extension of the infection from an acute appendicitis may travel alongside the colon by direct extension of the lymphatics usually to the right posterior space, or in a high appendix the anterior space (Case I.)

Infection from the appendix extending upward behind the ascending colon may reach the retroperitoneal space between the liver, diaphragm

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and reflections of the coronary ligament. In a lesion of such nature, the abdomen if opened in front, would show no peritoneal involvement, the abscess lying entirely retroperitoneally.

Perforated duodenal or pyloric ulcers result in a spread of the infection from below the liver, until the accumulation of fluid lies above the liver and below the diaphragm on the right side, in a position determined by the rapidity of the formation of adhesions (Cases IV, VII, VIII and XI). Perforations of the posterior wall or high on the lesser curvature of the stomach, which usually become adherent to the liver or pancreas may result in fluid exudations into the lesser sac, as may also occur secondary to an abscess of the pancreas.

Following the perforation of a duodenal ulcer, a litre or more fluid may accumulate. This of course is not all fluid which has escaped from the perforation, but is largely the result of peritoneal exudation caused by chemical irritation as well as low grade bacterial infection. The amount of this fluid and its position is determined by the formation of adhesions, the direction of its flow, and the size and subsequent closure of the perforation.

With the occurrence of a perforation anywhere along the gastro-intestinal tract, there is usually an escape of some air or gas. This may be very small in amount and the large amounts of gas frequently found in subphrenic abscess are largely the result of gas forming anaërobic bacteria such as the colon bacillus (Cases III, IV, XI). The side of the diaphragm affected is pushed upward, but not always in its entirety; that is, the anterior or posterior portions or that part closer to the midline and away from the axillary line, may be especially elevated, (Case XI). It does not move up and down normally with respiration. The liver is usually pushed down or may be very little displaced, even with a considerable quantity of fluid and air between it and the diaphragm. Secondary empyema may occur, or there may be a considerable quantity of clear fluid in the pleura, coincident with pus below the diaphragm, (Cases VIII and XI).

Symptoms and Diagnosis.—These variables mentioned under pathology make difficult the diagnosis, particularly confusing the physical signs. Following an operation for suppurative appendicitis or perforated duodenal or pyloric ulcer, the symptoms due to peritoneal irritation or infection continue or subside and then reappear after a number of days, usually gradually, (Case III). It is apparent that there is infection or pus somewhere and the difficult problem is to locate it. When the pathological condition occurs before operation, but secondary to a slow or small duodenal or pyloric perforation after a more or less acute onset of hypogastric or right-sided pain, the symptoms of the subphrenic abscess may develop more gradually and point to other conditions. In one case the acute right-sided pain radiated to the penis and seemed to point at first to a renal or ureteral colic, although the rigidity indicated peritoneal inflammation. (Case IV).

Usually when secondary and frequently when primary the condition is mistaken for some pathology above the diaphragm. This because a post-

operative pneumonia is unfortunately not infrequent and is always looked for when a post-operative case does not do so well and because the physical signs resemble so closely a pulmonary or pleural inflammation. Also, because of the frequency with which a patient with a beginning pneumonia complains of abdominal pain.

As usually described, the physical signs found are dulness or flatness, diminished breath and voice sounds and vocal fremitus with the presence of râles over the base of the lung. The area of dulness is characterized by being convex upward and not changing its area with a change of position of the patient. When gas is present in the abscess cavity, there are three zones of different resonance on percussion ; normal above, tympany caused by the gas below this, and the area of flatness caused by the pus, which is continuous with the liver dulness on the right side. When there is also fluid in the pleura an area of flatness forms a fourth zone between the pulmonary resonance and the tympanic zone caused by the gas beneath the diaphragm.

These are the classical signs recorded and would probably be present if each layer or zone were superimposed on each other evenly like a pile of books or a layer cake, but they are not, and frequently the physical signs become most confusing. The causes for the variations from the above classical signs and the reasons for confusion are:

(1) The fluid is not evenly distributed between the liver and the diaphragm, but being localized in a smaller area raises the diaphragm in a conical manner and is overlapped anteriorly, posteriorly or laterally by lung tissue.

(2) In the same manner, gas occupying the upper part of such an area is overlapped by lung tissue, or lies partly behind or in front of the solid liver.

(3) With a large accumulation of fluid pushing the diaphragm upward, the physical signs over the lung above are not those found over a normal lung but those of compression and closely resemble the physical signs of pneumonia or fluid in the pleural cavity.

(4) The air or gas in the cavity may be so small in amount that it causes no zone of hyperresonance, but may be just enough to mask the flatness or dulness.

(5) A marked amount of post-operative abdominal distention may push up the diaphragm sufficiently to cause all the physical signs of a subphrenic abscess.

(6) The usual physical signs closely resemble a pleurisy with effusion or empyema, and injudicious exploration with an aspirating needle may enter the subdiaphragmatic abscess and on withdrawal infect the pleura. Then the original lesion is masked by the empyema or pyopneumothorax which develops.

In addition to these conditions which mask or confuse the physical signs, there are other symptomatic findings which may not conform with the expected. Tenderness may not be elicited for obvious physical reasons. A considerable accumulation may be so well walled off that there may be

little absorption and therefore no or little temperature elevation or leucocyte increase, (Case XI). An exploratory needle puncture may pass through the elevated diaphragm and obtain pus which would appear to come from the pleural cavity. The needle may enter the cavity but only where gas is present and no pus be obtained. Cottle has reported a case in which a subphrenic abscess developed after the removal of the appendix and the excision of a duodenal ulcer. For three and one-half months there was lack of unanimity of opinion as to the diagnosis. The röntgenologist was persistent in his original statement that the fluid was probably in the abdomen but the physical signs and other clinical evidence failed to bring agreement. About four months after the abdominal operation, aspiration was performed and this showed that the pus was in the abdomen, not in the chest. Operation confirmed the diagnosis of subphrenic abscess.

Röntgenographic study with the fluoroscope and films is the best method not only of confirming or making the diagnosis, but also of determining the position and size of the fluid accumulation. Even this, however, may result in misinterpretation. It is most important that the examination be made in the erect position or sitting up, and if the patient is too ill to allow this, lying on the side opposite the lesion. This will allow the gas in the cavity to reach the highest point and often show a fluid level in the cavity. Failure to do this has resulted in a wrong diagnosis, which becomes simple on repeating the examination, (Case IV). While the fluoroscope may determine the position of the abscess and its antero-posterior as well as lateral relations, stereoscopic films are a great aid to the surgeon to determine his point of approach to the lesion.

A final word on diagnosis might be said concerning exploratory puncture. I believe that this should always be reserved until careful X-ray study has been made, if subphrenic abscess is suspected. Then it is often unnecessary. If done before as frequently happens, either no pus is found or if found, the withdrawal of the needle frequently involves the pleura, causing empyema or pyopneumothorax.

Operative Treatment.— Drainage. Careful radiographic study should determine the best line of approach to the abscess for the purpose of drainage. When the X-ray shows this to be in front, especially if the history and signs point to a recent duodenal perforation, a high anterior right rectus incision will usually allow the best method of exploration and drainage, (Cases IV and VIII). This incision is recommended as the subphrenic abscess is apt to be associated with accumulation of fluid below the liver and about the duodenum. Incision parallel with the free border of the ribs as advocated by some would appear to be particularly likely to be followed by a hernia most difficult of repair, if infection of the wound follows the drainage.

Posterior abscess is best approached by resection of the tenth rib in the posterior axillary line, under local anæsthesia. If done carefully, this may usually be accomplished without injury to the pleura which is carefully pushed upward, the costophrenic space entered and the diaphragm seen.

A large aspirating needle is then pushed through the diaphragm, the pus located and a small opening made in the diaphragm which is enlarged by stretching with scissors so that a large rubber tube may be introduced. If the pleura has been accidently opened, and it contains no fluid, it should be closed and the wound packed with gauze for twenty-four to forty-eight hours to allow adhesions to wall off the pleural cavity from the drainage tract before going through the diaphragm to enter the abscess, (Cases IX and X).

If empyema of the pleura is already present, the pleura may be drained by means of the usual resection of the seventh or eighth rib, and the abscess below the diaphragm approached by resection of the tenth rib in a different line or else both the pleura and the subdiaphragmatic space drained through the same incision, the latter opened twenty-four hours or more after the former, (Case XI).

It is also well to keep in mind, the necessity of continuing drainage for a sufficient time and the danger of the abscess cavity again becoming walled off if drainage be discontinued too soon or abruptly (Case I). In my opinion this is one of the very few occasions when tube drainage is indicated for drainage of pus or fluid below the diaphragm.

CASE REPORTS

Case I.—G. S., female, age thirteen, entered St. Luke's Hospital, July 31, 1911. Acute gangrenous appendicitis. High appendix with undescended cæcum, and abscess under liver. Adhesions between liver and diaphragm separated and pus evacuated and rubber dam drain inserted. Temperature fell but rose again and physical signs were present over base of right lung. The X-ray showed subphrenic abscess had again become walled off. Separation of adhesions and insertion of rubber tube well above liver caused profuse discharge. Ten days later this drainage again became obstructed. Temperature 103. Patient septic and jaundiced. Separation of adhesions again allowed free drainage. This was repeated four days later after which patient recovered.

Case II.—M. P., male, age eight. Englewood Hospital, November 7, 1910. Operation for acute appendicitis with general peritonitis. Temperature between 99° F. and 100° F. for ten days after operation. On fourth day complained of pain in left chest. Examination showed râles over left base behind but no other physical signs. On tenth day temperature rose to 104.3 and pulse to 180. The wound examination was negative and two consultants were unable to find any other physical signs than the previously mentioned râles over the left chest. No X-ray was taken. At 8 A.M. on the 12th day he developed a harrassing cough with scanty expectoration. One hour later there occurred a profuse enormous purulent expectoration which became bloody as œdema of the lungs developed, and he died in a little more than an hour, apparently drowned by the pus in the lung. The pus showed streptococci and a bacillus apparently the B. Coli. While not proven, it is believed that this was a left-sided subphrenic abscess rupturing into the lung and causing death.

Case III.—D. K., male, age twenty-two, operated on at St. Luke's Hospital for perforated duodenal ulcer, July 19, 1921, eight hours after perforation. Convalescence uneventful until August 11, when temperature began to rise. It reached 106 after a chill six days later. No signs of infection over wound. Dulness and diminished voice and breath sounds over right base. X-ray examination showed right side of diaphragm elevated but abscess was not located. On August 8th the radiograph showed two small gas bubbles between the liver and diaphragm. Three days later these gas areas had

increased in size, easily locating the abscess, which was drained by resection of the 10th rib under local anæsthesia.

CASE IV.—I. N., male, age twenty-seven. Admitted to Knickerbocker Hospital, January 2, 1924. Developed acute pain over entire upper abdomen on day of admission. Most marked on right side and radiating down into penis, suggesting right renal colic, although abdominal rigidity seemed to contradict this and suggested perforated duodenal ulcer. Temperature 99.2. Pulse 96. Leucocytes 11,000. Polymorphonuclears 76 per cent. The following day the temperature, pulse and leucocyte count had risen and there was marked dulness and flatness with bronchovesicular breathing and voice sounds over right base. X-ray diagnosis made of beginning pneumonia on right side, although pain, tenderness and abdominal rigidity persisted. It was then suggested that the radiograph be taken with patient on his side, which confirmed the diagnosis of subphrenic abscess, containing gas. Even then, as the patient's chest had been aspirated and pus obtained, the diagnosis of empyema was persisted in by the medical consultant who induced the operator to explore the chest before opening the abdomen. The pleura was explored after rib resection under local anæsthesia, and no fluid found. A right rectus incision was then made by Dr. C. A. Frink, and a large amount of foul-smelling fluid found about the duodenum and under the liver and running down into the right kidney region. There were adhesions along the anterior border of the liver which when separated allowed the escape of another large quantity of similar fluid. Drainage was established but this patient died five days later.

CASE V.—C. B., female, age forty-seven. Admitted to Knickerbocker Hospital, January 15, 1924. She was shot with a revolver. The bullet passed in and out through the right breast and entered the chest wall just above the costal margin in the mammary line. X-ray showed it to be located about 2 cm. to the left of the 10th dorsal vertebra. The patient had a complete motor paralysis of both legs from Poupart's ligament down, with the exception of the right adductor group. Sensation lost in left leg but present in right. There was marked dulness and diminished breath and voice sounds over the right base. Radiographic examination showed the diaphragm pushed upward to the level of the 5th rib, and allowed a diagnosis to be made of effusion of blood between the liver and diaphragm instead of a hæmothorax caused by the passage of the bullet. The signs of this fluid gradually disappeared without treatment.

CASE VI.—M. D., aged fifty, female, was seen in November, 1913, complaining of pain under the left costal margin with a dry hacking cough and no expectoration, and running an irregular temperature which sometimes went as high as 104.5, with night-sweats. There was dulness, diminished breathing and voice sounds over base of the left lung posteriorly. There were no râles. After several attempts at exploration with the needle, pus was found by consultant. It was not determined whether it came from above or below the diaphragm. It was sterile on smear and culture. X-ray showed left diaphragm elevated and having a diminished excursion. She was operated on November 25, 1913, in the Polyclinic Hospital. Resection of the tenth rib, along the posterior axillary line, showed the diaphragm thickened. Aspiration through the diaphragm demonstrated pus. The abscessed cavity was drained. Pus was sterile. A section removed from the diaphragm showed actinomycosis. After treatment with potassium iodide, patient was discharged cured. This case was reported in the ANNALS OF SURGERY, vol. lx, 1914, p. 389.

CASE VII.—W. R., male, age twenty-six, was admitted to the medical ward of St. Luke's Hospital, October 31, 1916. He gave a history of acute abdominal pain on the right side the day before admission. A similar attack of three days' duration occurred two and one-half years previously. Physical signs over the right base caused a diagnosis of "lobar pneumonia" (?), although the history stated that the patient vomited dark brown fluid several times on the day of admission and had marked tenderness and rigidity ("voluntary"?) over the right upper quadrant. He was treated with mustard paste to chest and flaxseed poultices to the abdomen, Murphy drip and colon irrigations. X-ray

on November 1st showed no pneumonia and gas was demonstrated underneath the diaphragm. A mass then appeared in the right upper quadrant, extending from the lower border of the ribs to the umbilicus. He was transferred November 8th, eight days after admission, to the surgical side for operation with a diagnosis of "abscess, secondary to perforated duodenal ulcer." He was kept on the surgical side for three days longer, during which time a cystoscopic examination was done to determine the condition of the right kidney.

Operation was done November 11th by Dr. Walton Martin; right rectus incision, at the level of the umbilicus. Abscess cavity containing several ounces of foul-smelling pus evacuated. Culture showed short chain streptococci. Discharged December 3rd. A radiograph taken on December 2nd showed duodenum not filled, indicating ulcer or adhesions.

CASE VIII.—C. H., male, age thirty-four, admitted to the medical ward of St. Luke's Hospital on June 22, 1920. Acute pain in right abdomen two weeks before admission, began in right lower quadrant, and then extended to right upper quadrant. Temperature after admission ranging from 100–104. Pulse 72–104. Had bad teeth but no history of gastric disturbance since 1917. In 1916 had operation for acute appendicitis, and was operated on for acute obstruction in 1917. Physical signs over right base caused diagnosis of "pleurisy with effusion." Exploratory puncture of right pleura showed 15 c.c. of bright fluid which looked like changed blood. June 23rd, X-ray diagnosis of fluid in right chest cavity. Thirty-four ounces of clear yellow fluid was withdrawn. June 25th, tender mass appearing below costal border of ribs anteriorly. Tympanitic note over mass. July 1st, X-ray shows gas under diaphragm, suggesting subphrenic abscess, also probably fluid in chest cavity. July 2nd, exploratory chest puncture. No fluid obtained. July 3rd, transferred to surgical side for operation. July 4th, operation by Dr. Richard Bolling. Tenth rib resected and exploration done with needle downward found air but no pus. Right rectus incision then made which revealed large abscess extending over upper surface of liver as far as could be reached with the hand. This was drained and patient left hospital four weeks later. Before leaving, the radiographic examination of the gastro-intestinal tract showed a twenty-four-hour stomach retention and deformity of the duodenum, indicating probable cause of abscess as duodenal perforation.

CASE IX.—M. V., female, age thirty-three, admitted to the medical ward of St. Luke's Hospital, September 6, 1916, with a history of four months' pain in the right hypochondrium and upper abdomen. Two months before admission had an attack of jaundice with vomiting. No cough up to two or three days before admission. Temperature ranged between 101 and 106. Physical signs over base of right chest caused diagnosis of "acute pleurisy with effusion." Aspirated on day of admission; one-half ounce of clear fluid obtained. The following day five ounces of dark bloody fluid obtained. September 18th, 15 c.c. of dark brown, very thick pus. X-ray report September 8th, "There is a dense shadow involving the right side of the chest and displacing the heart to the left. The exact nature of the shadow is hard to determine, but is dense enough to indicate fluid, although no definite fluid level is observed in this position." Transferred September 9th to the surgical side with diagnosis of empyema. Operation: September 9th, Dr. M. K. Smith; rib resected two and one-half inches below angle of scapular. No fluid in pleura, but exploration with needle through diaphragm obtained pus. Seventy-two hours later second operation done through original incision. Diaphragm opened and echinococcus cyst of the liver drained. November 1st, X-ray showed the diaphragm remains very high on the right side and there is a diffuse shadow involving the lower chest on this side.

CASE X.—M. P., female, age seven. Admitted to St. Luke's Hospital, private patient of Dr. F. S. Mathews, October 10, 1917. Had been ill three weeks. Abdominal symptoms at first; later thought to be pneumonia. Aspiration through chest got foul-smelling pus. Liver prominent in epigastrium. Lung signs not marked. X-ray shows fluid and gas apparently below diaphragm. Diagnosis of subphrenic abscess made by Doctor Mathews. Tenth rib removed. Pleura opened. Wound packed and diaphragm opened

two days later. Large pus cavity found between liver and diaphragm. Five months later patient again admitted to the hospital and operated on for acute appendix abscess.

CASE XI.—E. M., male, age sixty-six, was admitted to the surgical ward of St. Luke's Hospital on November 25, 1923, service of Doctor Downes, with a diagnosis of "acute abdominal condition." He had been suffering from severe abdominal pain for twenty-four hours. Pain came on suddenly, was worse in the right upper quadrant and required morphine for relief. No vomiting. He had suffered from heart trouble with anginal pain in chest and arms for the past five years; was told that he had lead colic several years ago, but had never had so severe an attack of abdominal pain before. About three months before admission he had pneumonia and said he had never felt quite well since. Physical examination showed general abdominal tenderness and board-like rigidity, most marked in right upper quadrant. No masses felt. There was dulness over the right base and râles in both lungs. Enlargement of the heart to the left with a systolic murmur at the apex. On account of patient's cardiac and possible pulmonary condition, it was decided not to operate. Urine contained many hyalin casts. His abdominal pains disappeared. Leucocytes dropped from 16,800 to 9000 and he was quite dyspnœic and irrational at times. Medical consultation held and patient transferred to medical service, with a diagnosis of "nephritis of nitrogen retention type." His temperature after transfer became elevated, and on November 30th, five days after admission to the hospital, fluid was found in his right chest and 360 c.c. of straw-colored fluid withdrawn. This culture showed staphylococcus albus. On December 12th, twelve days later, a radiograph was taken, showing evidence of a cavity with fluid level on the right side and gas probably below the diaphragm. He was then transferred back to the surgical ward on December 23, 1923, eleven days later. The following day a thoracotomy was done by Doctor Downes, the cavity containing very foul gas but very little fluid or pus. Drainage tubes were inserted in the cavity which drained moderately. Temperature came down and condition improved. Subsequent X-rays showed drainage tubes not in the original cavity and a probe passed through the drainage tract enters the chest cavity to the outer side and behind the original abscess cavity. January 7, 1924, a second operation was performed through the original incision, at which had been resected apparently the eighth rib. On entering this wound the finger entered a cavity, which was separated above from the general pleural cavity which had previously been opened, by a thin layer of tissue which the writer believes was the parietal pleura forming the upper boundary of the costophrenic sinus. A more dense layer of tissue forming the floor of this cavity was opened into and a large cavity containing foul pus and gas was entered. The operator was not able to determine whether this tissue passed through was diaphragm. The cavity was drained. The abscess diminished in size and the X-ray then showed that the fluid level had disappeared. The upper part of the cavity moves with respiration as shown by the fluoroscope, probably indicating that this is diaphragm." A subsequent gastro and intestinal series on January 23, 1924, was of no aid in clearing up the diagnosis. On discharge the only X-ray findings was a small amount of thickening in the region of the costophrenic sinus. An X-ray since discharge shows that this has almost disappeared.

SUMMARY.—There are eleven cases reported. Of this nine were on the right side, two on the left. Seven were males, four females. Nine recovered, two died. Eight occurred as a pre-operation lesion; three post-operatively as a complication during convalescence. Five were probably the result of perforated duodenal ulcer, although this was not always proven; three of appendicitis, one due to actinomycosis, one to echinococcus cyst of the liver, and one to a bullet wound of the upper portion of the liver.

In the study of these cases one is impressed with the fact that there was, in most of the cases, a mistake or at least a delay in the diagnosis, due to the belief that the lesion was above the diaphragm. In six of the acute cases

there is a distinct history of severe abdominal pain, often accompanied by rigidity and sometimes by vomiting. In one case of coffee ground material. In most of the cases the X-ray showed an elevated diaphragm and usually gas below the diaphragm or would have shown the gas, if properly taken. However, the physical signs over the base of the lung, usually due to compression by the elevated diaphragm and mistaken for pneumonia or fluid in the pleura, or to fluid which had accumulated in the pleura secondary to the infection below, caused the evidence of an abdominal lesion to be disregarded. Only so can these mistakes and delays be explained.

It is therefore believed that such mistakes and delays and secondary chest infections from needle explorations would occur less often if: First, it is kept in mind that compression caused by fluid below the diaphragm may cause physical signs closely resembling a lesion in the chest; second, the symptoms of an acute abdominal lesion be given their true significance; third, radiographic study repeated if necessary, and made in the erect, or if this seems unsafe, in the lateral posture be carefully carried out.

The writer thanks Doctors Martin, Downes, Mathews, Bolling and Smith for permission to include cases operated on by them, in this paper, and also Dr. L. T. Le Wald for the use of several lantern slides from his collection in presenting this paper to the New York Surgical Society.

REVIEW OF FIVE THOUSAND FOUR HUNDRED AND EIGHTY-EIGHT APPENDECTOMIES PERFORMED AT THE LANKENAU HOSPITAL OF PHILADELPHIA

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There are certain subjects in medicine which owe their interest to their unusual and rare incidence; while others attract attention because of their frequency. It would be perfectly logical to infer that the latter class would present few difficulties of diagnosis and of treatment. But the theory in this instance does not conform to the fact, as far as so common a disorder as appendicitis is concerned. Owing to the ability of the appendix to mimic other abdominal disorders, which in turn is in large measure due to the tendency of the organ to deviate in position from its normal location in the right iliac fossa, the diagnosis of appendicitis continues to present difficulties both to the experienced and the tyro in diagnosis. However, if it is remembered that appendicitis is undoubtedly the commonest acute pathologic process met with in the abdomen, and if the sequence of symptoms: Pain, vomiting, tenderness in the right iliac fossa, fever and leucocytosis is kept in mind, fewer mistakes in diagnosis should result. In the majority, if not in all instances, the pain precedes the vomiting. Abdominal pain with tenderness in the region of the appendix is of far greater value from a diagnostic standpoint than an increase in the pulse rate, temperature and leucocytes, although occasionally a rise in the leucocytic count is of great aid in the diagnosis. The importance of making a vaginal and rectal examination in cases of acute abdominal pain should be emphasized. Occasionally there is slight tenderness in the right iliac fossa, either with or without tenderness in the left iliac fossa, and in such instances a rectal examination will disclose acute tenderness from an inflamed appendix lodged in the pelvis. The following history will illustrate this point: A young man twenty-five years of age had had three attacks of acute pain in the abdomen following indulgence in alcohol. The pain was generalized throughout the abdomen and accompanied by vomiting, the vomitus occasionally containing blood. There was slight tenderness in the epigastrium, and slight rigidity of the upper recti. A rectal examination was not made. The diagnosis was subacute perforation of a gastric ulcer. An upper abdominal incision revealed the stomach, duodenum, and gall-bladder to be normal. A rectal examination was made, a mass was palpated through the right rectal wall; this proved to be a gangrenous appendix, which was removed through a low right rectus incision.

Acute appendicitis may be accompanied by diarrhœa, although it is not

common, but in any case of acute pain in the abdomen associated with diarrhœa, the appendix should be thought of.

It is the custom in the Lankenau Hospital, in the absence of complications, to operate immediately on all patients seen in the first thirty-six hours, but where the symptoms are of longer duration the procedure varies. In the presence of a spreading peritonitis immediate operation is contra-indicated. These patients are best treated by placing them in the sitting position, with an ice bag to the abdomen, administering proctoclysis with normal saline solution, together with hypodermoclysis and moderate doses of morphia, and giving nothing by mouth. The saturation of the patient with opium, as advocated by some surgeons, seems a poor method of treatment. In 1918, we advocated non-interference in this type of case until localization had occurred. W. J. Mayo, as well as Jopson and Pfeiffer, have recently expressed similar opinions. Jopson and Pfeiffer say: "Now we know that by far the greater part of the mortality from appendicitis comes from the group which exhibits when first seen a widespread peritonitis with evidences of profound systemic toxæmia, and usually in the third or later days of the disease. Leaving aside the question of elimination of this type of case by more timely recognition, it is evident that the reduction of surgical mortality must deal chiefly with this group. Those who have made use of Ochsner's Fowler-Murphy plan cannot fail to have been impressed with the general improvement, and localization of the peritoneal process that may occur in seemingly desperate cases. Nor can they have failed to note that other cases exhibit no such tendency but proceed to generalization and death. On the other hand, those who practice immediate operation must often have had the experience that the post-operative condition of the patient is obviously worse than before operation, and death results from progressive toxæmia, within a few hours or days. * * * On the other hand, there are certainly cases that show no tendency towards localization and will inevitably perish under any waiting policy. In the body of this paper we have made a plea for recognition of certain types which are likely to fall into this group, notably: (1) young children, (2) cases of delayed and fulminating gangrene or perforation, and (3) intra-abdominal rupture of a localizing or localized abscess."

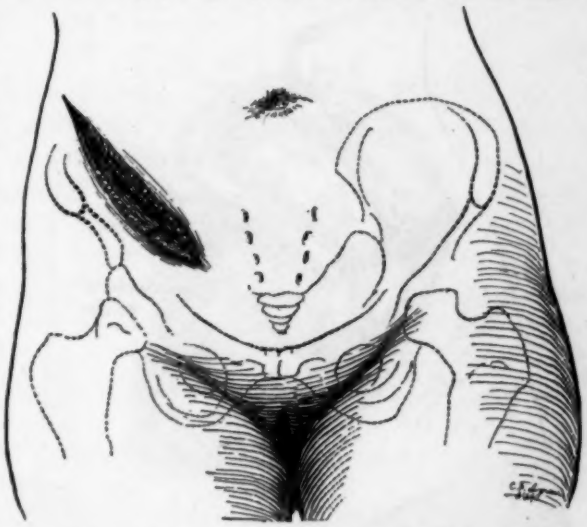

FIG. 1.—Incision for the extra-peritoneal approach to the appendix.

In the cases seen in the first few hours a McBurney, or a low right rectus incision may be used. If there has been a spreading peritonitis with localization, the incision will depend somewhat on the position of the abscess. If there is a mass in the right iliac fossa, the extraperitoneal approach, as used by us, is of advantage. The incision (Fig. 1) begins about 4 cm. behind the right anterior superior spine of the ileum and extends down over the mass approximately parallel to Poupart's ligament. The muscle fibres of the oblique and the transversalis muscle are cut transversely, and the abscess approached from the lateral side. After the peritoneum is opened the small intestines (Fig. 2) are carefully packed towards the mesial side, and the appendix and cæcum are disclosed with the abscess. The appendix is removed in most cases with, but sometimes without, inversion of the stump, depending on the pathologic condition present. A glass tube is passed into the pelvis, through which fluid, if present, is aspirated. Also any extension into the subhepatic fossa is noted. Drainage is then instituted (Fig. 3), usually with cigarette drains; one being passed to the pelvis, one along the external surface of the ascending colon, and one to the stump of the appendix. A small piece of gauze is then wrapped around the drains and the wound loosely closed with through-and-through interrupted sutures of silkworm gut. Another piece of gauze may be placed in the wound. The wound is kept moist with Wright's solution. In from four to six days, one drain is removed, and a small rubber tube introduced in its place. This is repeated in the succeeding days with the other drains, and the wound is irrigated with a saline or weak carbolic solution every day. The wounds usually heal by granulation and without complications. It is possible that this incision may be followed by a higher percentage of post-operative hernias than the type usually employed. We believe, however, that its advantages far outweigh this fault, as the hernia may later be repaired with comparatively little risk. The drainage described will, of course, vary with the areas involved in the abscess. In cases in which there is no mass, or in which the mass is near the middle of the abdomen, a

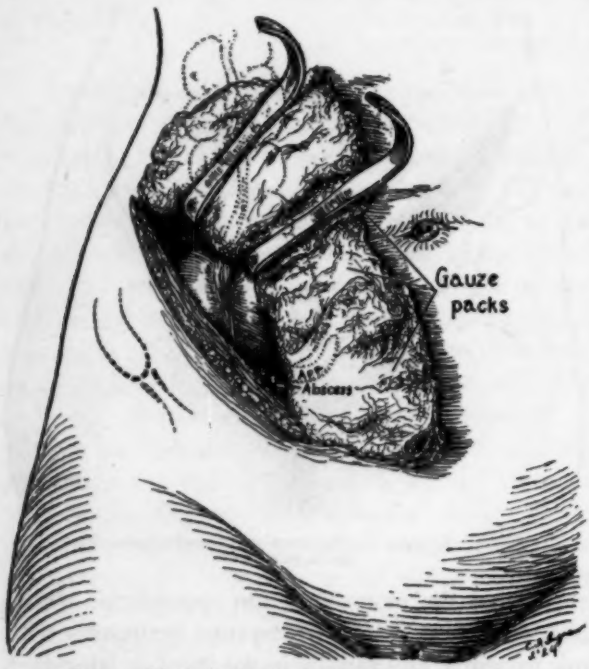

FIG. 2.—Method of walling off appendix and cæcum.

low right rectus incision can be made. The post-operative treatment is essentially the same as the pre-operative.

It may be well here to protest against the exploration of the upper abdomen in the presence of a gangrenous appendix and abscess. While an associated lesion, such as perforation of the gall-bladder, or peptic ulcer, or Meckel's diverticulum, may occasionally occur, in our experience this is not common. If the condition of the appendix is not sufficient to account for the symptoms, exploration is certainly advisable, but in the presence of an abscess the indiscriminate exploration of the abdomen is disastrous. The clinical findings also will aid in the elimination of multiple lesions.

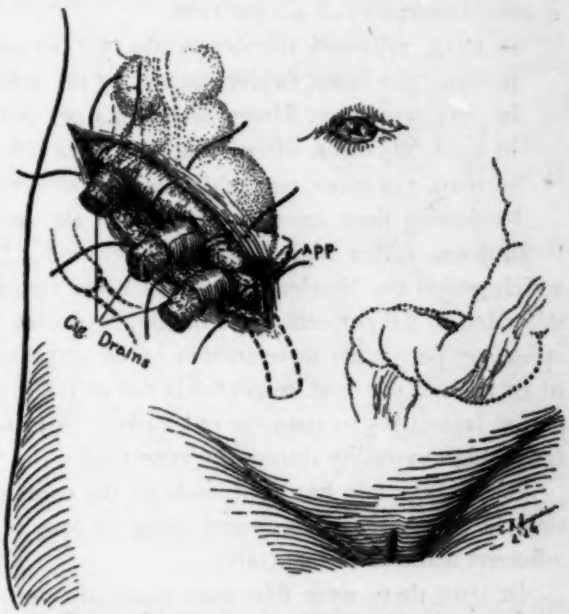

FIG. 3.—Drainage employed in appendiceal abscess.

During the years 1900 to 1920, 5488 appendectomies were performed in the Lankenau Hospital for acute appendicitis, with 327 deaths, a mortality of 5 per cent. These operations divided into five-year periods give data as follows:

In 1901, 135 cases with twenty-six deaths, 19.2 per cent.

In 1902, 271 cases with thirty-seven deaths, 13.6 per cent.

In 1903, 268 cases with twenty-two deaths, 8.2 per cent.

In 1904, 395 cases with twenty-five deaths, 6.3 per cent.

In 1905, 289 cases with thirty-three deaths, 11.4 per cent.

Thus within the years 1901 to 1905 there were 1358 operations with 143 deaths, a mortality of 10.5 per cent. It was the custom, in this period to operate on all patients suffering with acute appendicitis when first seen, regardless of the extent of the disease. In the next five years many of the patients with spreading peritonitis were treated expectantly by the Fowler-Murphy-Ochsner treatment, but it was not until 1910 that this treament was instituted in all cases of spreading peritonitis.

In the years 1906 to 1909 there were 1159 operations on patients with acute appendicitis with sixty-five deaths, a mortality of 5.6 per cent.

In 1906, 317 cases, fifteen deaths, 4.7 per cent.

In 1907, 315 cases, fifteen deaths, 4.7 per cent.

In 1908, 266 cases, seventeen deaths, 6.2 per cent.

In 1909, 261 cases, eighteen deaths, 6.9 per cent.

The total for the five years, 1910 to 1914, was 1385 cases with fifty-two deaths, a mortality of 3.7 per cent.

In 1910, 275 cases, seven deaths, 2.5 per cent.

In 1911, 257 cases, seven deaths, 2.7 per cent.

In 1912, 297 cases, eleven deaths, 3.6 per cent.

In 1913, 263 cases, fourteen deaths, 5.3 per cent.

In 1914, 293 cases, thirteen deaths, 4.4 per cent.

For the years 1915 to 1919, there were 1585 operations, with sixty-seven deaths, a mortality of 4.2 per cent.

In 1915, 305 cases, thirteen deaths, 4.2 per cent.

In 1916, 322 cases, twelve deaths, 3.7 per cent.

In 1917, 340 cases, fifteen deaths, 4.4 per cent.

In 1918, 285 cases, fifteen deaths, 5.2 per cent.

In 1919, 334 cases, twelve deaths, 3.5 per cent.

Reviewing these cases it is seen that the mortality within the years 1901 to 1905 was rather high, being 10.5 per cent. In the next four years within which period the Fowler-Murphy-Ochsner treatment was instituted the mortality fell to 5.6 per cent., and finally, beginning with 1910, when all cases of spreading peritonitis were treated by the expectant method, the mortality fell to 3.7 and 4.2 per cent. respectively for each five-year period. In the five-year period from 1915 to 1919 the epidemic of influenza no doubt accounts for the rather high mortality during the year 1918.

A careful study has been made of the cases of appendiceal abscess occurring during the years 1918 and 1919, because it was during these years that influenza affected the mortality.

In 1918 there were fifty-nine cases of appendiceal abscess. Eight (13.5 per cent.) of the patients died. The ages of the patients were:

Years	Number
1–10	0
11–20	18
21–30	25
31–40	8
41–50	5
51–60	2
61–70	0
71–80	1

The average length of hospitalization was from three to five weeks, the shortest time being two weeks and the longest fifteen weeks. The patients arrived at the hospital anywhere from one to twenty-eight days after the onset of the attack. The majority had been ill from two to six days before admission. Eight were operated on immediately. Thirty were operated on after one day on the Fowler-Ochsner treatment. Six were kept on this treatment for two days, four for three days, and one each for four, five and nine days.

A single purgative had been given in thirty-nine cases, multiple purgatives were given in four, while in sixteen no purgative was mentioned. A mass was definitely palpable in twenty-eight cases; there was a questionable mass in nine, and no mass in twenty-two. The incision employed was extraperitoneal in forty-eight, a large McBurney in five and a lower right rectus in six. The location of the abscess was said to be: Around the cæcum and terminal ileum in eight, in the pelvis in thirteen, and around the cæcum in thirty-four, in the omentum in one, behind the terminal ileum in two, retrocæcal in twelve, subcæcal in one, subhepatic in two, and subdiaphragmatic in five.

In several cases there were multiple abscesses in the pelvis, around the cæcum, or in the subdiaphragmatic area. The complications following operation were:

Obstruction of the ileum two cases, wound abscess, two cases, fecal fistula five, right-sided empyema two, secondary abscess two cases, hernia in one instance.

In one case there was an opening into the cæcum at the time of operation which was repaired, followed by an uneventful recovery.

Of the eight patients who died, all were under thirty-six years of age, and only one had not received a purgative during the illness. One patient had subhepatic and subdiaphragmatic abscesses with multiple abscesses in the coils of small intestine, and an abscess in the pelvis. A secondary operation was performed twenty-three days after the primary one and multiple secondary abscesses were found. Post-operative parotitis developed followed by death. This patient also had a cough with expectoration before the primary operation. Another of this group had a retrocæcal abscess, and later developed miliary tuberculosis with bacilli in the sputum, followed by death.

In one instance, retrocæcal, subhepatic and subdiaphragmatic abscesses were found at operation. Twenty-one days later a second operation was performed for multiple obstruction of the small bowel, and an abscess was found beneath the spleen. Death resulted two days later.

In another there was an abscess around the cæcum. Following operation a fecal fistula developed with secondary subdiaphragmatic abscess. This was drained. Two weeks later a right-sided empyema developed, and a rib resection was performed. Death occurred on the same day.

Case E. A.—At the primary operation the peritonitis was not well localized. A fecal fistula resulted and was repaired four weeks later. In about ten days a right-sided empyema occurred. A rib resection was performed, and death occurred in seven days.

The other three deaths occurred from toxæmia following the primary operation. All of the fatal cases had been kept on "regulation" treatment for from one to nine days before operation.

In *1919* there were eighty-six cases of appendiceal abscess; nine (10.4 per cent.) of the patients died, one died without operation.

The ages of the patients were:

Years	Number
1–10	0
11–20	22
21–30	29
31–40	15
41–50	13
51–60	4
61–70	2

The average length of hospitalization was three to five weeks, the shortest time was one week and the longest eleven weeks. The patients were sick from one to twenty-one days before coming to the hospital. Twenty-six were operated on immediately on admission, thirty after remaining in the hospital on the Fowler-Ochsner treatment for one day; sixteen for two days; four for four days; four for three days; two for six days; and one each for five, seven and eight days. A purgative had been given (before admission) to sixty-five of these patients, multiple purgatives to seven, no purgatives to nine; no purgative was mentioned in four instances.

A mass was definitely palpable in thirty-nine cases, and was said to be in the right iliac fossa in fourteen. No mass was present in thirty-one cases, while in fifteen this item was not indicated in the history. The extraperitoneal approach was used in thirty-one cases, an enlarged McBurney incision in twenty-seven, a low right rectus incision in twenty-seven, and a high right rectus in one. The abscess was located as follows:

Retrocæcal in nineteen cases, around the cæcum forty-two; in the pelvis, nine; between the ileum and its mesentery in six; subdiaphragmatic five, subhepatic four, outer side of cæcum two; between the ascending colon and the ileum one. The complications following operation were:

1. Fecal fistula. In this case the cæcum had almost ulcerated through at the time of operation. The fecal fistula was repaired and an ileocolostomy performed. Recovery.
2. Fecal fistula repaired and ileocolostomy performed. Recovery.
3. Fecal fistula and obstruction of bowel. Resection of the cæcum and ascending colon, ileocolostomy. Recovery.
4. Fecal fistula, closed spontaneously. This patient developed incisional hernia, following the extraperitoneal approach type of incision. Repair of hernia, recovery.
5. Fecal fistula resection of cæcum and ileum, and ileocolostomy performed. Recovery.
6. Fecal fistula repaired. Recovery.
7. Fecal fistulas in three cases, closed spontaneously. Recovery.
8. Parotitis in two cases. Recovery.
9. Lobar pneumonia. Recovery.
10. Streptococci pneumonia. Death.
11. Pulmonary œdema. Death.
12. Diarrhœa and hemorrhage from bowel. Death.
13. Abscess of scrotum, incision and drainage. Death.

In one of the nine patients who died, the abscess was not located at the first operation and a secondary operation was not performed. Of the eight other cases, seven had been purged before operation. The extraperitoneal type of incision was employed in four, the enlarged McBurney in three, and a right rectus in one. In four of the cases death resulted from toxæmia following operation. One was associated with a subdiaphragmatic abscess and three with pneumonia.

SUMMARY

Acute appendicitis is, in the majority of instances, a disease of early adult life, although it may occur at any age.

In neglected cases the patients will remain in the hospital from three to five weeks after operation.

A purgative should never be given to patients with acute abdominal pain, until inflammation of the appendix is excluded.

The mortality in this disease has decreased practically 50 per cent. during the last decade, and while the general increase in knowledge concerning it may partially account for this it would seem as if the expectant treatment of spreading peritonitis, as described, is also of value.

After the peritonitis has localized and a mass is present, the incision as described will be of value in the extraperitoneal approach to the ileum. In practically every case the appendix can be removed. Drainage varies with the situation of the abscess. Cigarette drains and pieces of gauze are commonly used, and occasionally as in pelvic abscess, a glass tube is used.

The highest mortality follows subdiaphragmatic abscess or multiple abscesses.

If the cæcum or ileum is indurated or ulcerated at the primary operation, fecal fistula will occasionally occur.

When the appendix, with the abscess lies under the terminal ileum, obstruction may follow.

In conclusion, it should be emphasized that prompt diagnosis and appendectomy will do away with many of these serious post-operative complications.

A REPORT ON 262 CONSECUTIVE CASES OF APPENDICITIS*

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There seems to be an opinion widespread among physicians that the problems connected with the medical and surgical treatment of appendicitis are solved. That this complacent attitude is not justifiable is shown by the most superficial study of the mortality statistics of the Bureau of Census, and of the results of operations published by various clinics. The number of deaths from appendicitis reaches an appalling figure.

During the year 1917 there were 9374 deaths from appendicitis in the registration area of the United States. In 1919 there were over 10,000 deaths, and in 1920 a few more than 11,000 deaths. These deaths were distributed in age groups as follows:

Age	Number of deaths
All ages	11,260
Under 5 years	425
5 to 14 years	2,130
15 to 44 years	5,906
45 to 64 years	2,229
65 years and over	570

There are no statistics on the total number of cases of appendicitis in the registration area, but a fair average figure for the mortality in all cases of appendicitis as given by most authorities is ten per cent. Therefore, with ten thousand deaths we may safely assume at least 100,000 cases in the registration area for 1920. The above data show clearly that the general population is not receiving the full benefit of our present scientific knowledge of appendicitis.

Considering the mortality rate for appendicitis reported by various clinics, we are struck by the great range of figures. Thus some surgeons report as low a death rate as two per cent., and others as high a rate as 15 per cent. It is improbable that this wide variation can be accounted for by the differences in virulence of the disease in different communities. More likely it is due:

(1) To what the individual surgeon regards as acute appendicitis.

(2) To the time in the disease at which operation is performed.

(3) To differences in the medical and surgical management of the disease.

It is obviously of little value to strike an average of the widely varying

* From the Department of Surgery, Indiana University School of Medicine. Read before the Tri-State District Medical Society, Des Moines, Iowa, October, 1923.

mortality statistics. Furthermore, an especially low mortality rate does not necessarily imply better surgical treatment, nor does an especially high mortality figure condemn the work of the clinic reporting it. In the series here reported, in order that there may be no question of the nature of the disease, we have included only cases in which there was unmistakable, grossly recognizable gangrene or impending gangrene of the appendix. The report therefore represents the results obtained in the surgical treatment of the most advanced and dangerous cases. It has been our practice to employ drainage wherever there was manifest infection of the periappendiceal structures. Cases in which such infection had not occurred, in other words, in which there was contamination but not infection of the peritoneum, were closed without drainage. Of the 262 cases, 205, or 78.21 per cent., were pus cases. A five-day interval between onset of symptoms and admission had occurred in 144 of the 205 suppurative cases. A two-week interval had elapsed in 17 cases. Three had been sick twenty-one days; one twenty-eight days, and still another thirty-five days. Of the 205 pus cases only thirty-nine had been brought to the hospital sooner than five days after the onset of symptoms. The majority of them had been severely purged before admission. Most of the patients came from rural communities within a radius of 100 miles of Indianapolis. Only 10 per cent. came from its immediate neighborhood.

This fact has a bearing on the time interval between the onset and date of admission. The family physician is commonly held responsible for delay of operation for appendicitis, but in our series he is not altogether to blame. A surprisingly large number of patients had not been seen by a doctor until just before admission. Very few of the patients came to the hospital without the correct diagnosis.

The death rate in our series was 8.7 per cent., if we include four patients who died immediately after admission and without operation, and 7.2 per cent. if these cases are excluded. The death rate for the 205 suppurative cases was 9.2 per cent. In the 53 cases not drained, there were no deaths. The following table gives the age incidence of the disease in our series.

Age	Males	Females	Both sexes
0 to 5 years	1	2	3
5 to 10 years	14	13	27
10 to 20 years	62	39	101
20 to 30 years	33	14	47
30 to 40 years	25	13	38
40 to 50 years	15	6	21
50 to 55 years	5	0	5
55 to 60 years	3	0	3
60 to 65 years	3	2	5
65 to 70 years	2	0	2
70 to 75 years	1	0	1
Age not given	4	5	9
Totals	168	94	262

The accompanying curve (Fig. 1) gives a graphic representation of the age distribution stated above.

The deaths were distributed as follows:

Age	Males	Females	Both sexes
0 to 5 years	0	0	0
5 to 10 years	2	1	3
10 to 20 years	3	0	3
20 to 30 years	4	0	4
30 to 40 years	3	2	5
40 to 50 years	1	0	1
50 to 55 years	1	0	1
55 to 60 years	1	0	1
60 to 65 years	2	0	2
65 to 70 years	2	0	2
70 to 75 years	1	0	1
Totals	20	3	23

The foregoing tables show that the greatest incidence of appendicitis is between the ages of ten and thirty years, and also that the greatest total number of deaths occurs between these years. The death rate, however, is lowest in this period.

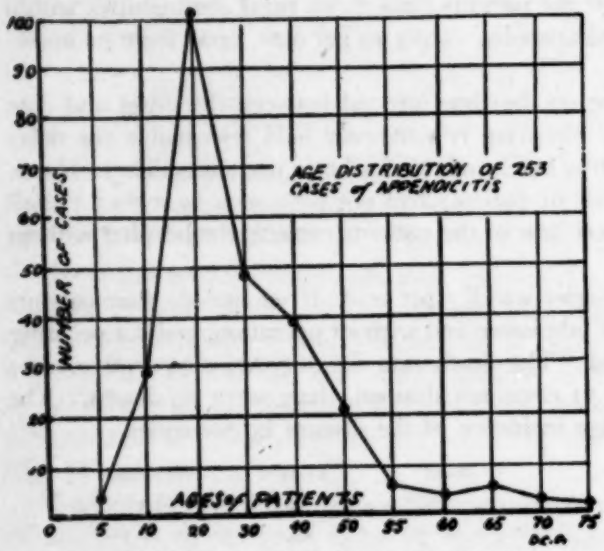

FIG. 1.—This table does not include the patients listed above as "age not given."

Of the 53 cases treated without drainage, as before stated, there were no deaths. A study of the clinical histories of this group shows almost without exception that operation was performed within the first twenty-four hours of the onset of the disease. The favorable outcome in such cases is to be expected as a matter of course. In many of them, however, gangrene was already present. Since the advantages of prompt diagnosis and early operation are universally admitted, it is needless to emphasize this point further.

The chief interest of this paper is in the group of two hundred and five advanced cases. That we are able to report such a series shows that the surgical management of these cases is still an important problem. We shall state first the surgical methods employed. Every patient was operated upon shortly after admission. As a pre-operative measure we used intravenous

injections of normal saline solution (800 c.c. to 1000 c.c.) for adults, whenever the patient was in poor condition. This in every case produced a marked improvement of the general condition. Dehydration is the chief cause of the marked circulatory failure which many of these patients have. It is brought about by vomiting, purging, and fever. The administration of the normal saline produces a most striking improvement in the pulse rate and blood-pressure and makes the operation comparatively safe. Light ether anæsthesia was used in all cases. Two hundred and twenty-nine cases were operated upon through a McBurney incision and 31 through a right rectus or midline incision.

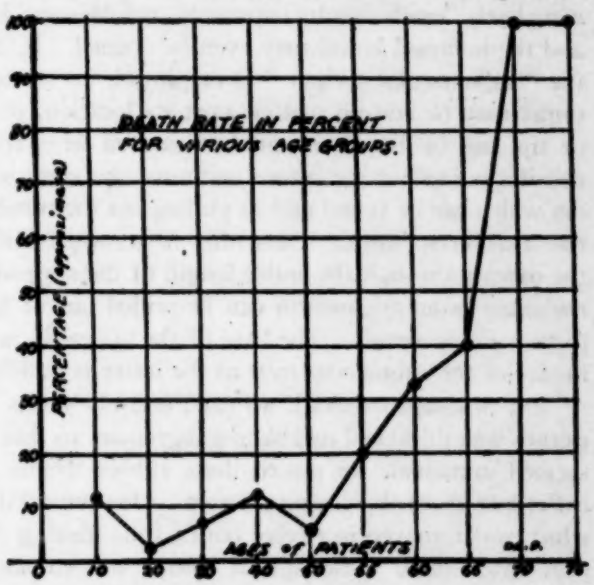

FIG. 2.—Table representing death rate for various age groups.

With increasing experience we have used the McBurney incision almost to the exclusion of all others. Our results have shown its striking advantages. Thus, of the 11 cases who died of peritonitis, 7 were operated upon by the McBurney route and 4 by right rectus of midline incision. Of the 7 operated through the McBurney incision five had general peritonitis at the time of operation and two did not. Thus in only two cases out of the 229 operated upon through the McBurney incision could death possibly be attributed to dissemination of infection at the time of operation.

Moreover, among the patients who recovered, the McBurney cases had far less trouble than those operated upon through other incisions, and the period of convalescence was greatly shortened. The average stay in the hospital after operation of the McBurney cases was twelve days, of the right rectus and midline cases fifteen days. These figures are for the group as a whole.

Another bit of operative technic which we regard as important, is the avoidance of the use of gauze packs to wall off the region of the abscess. These traumatize the peritoneal surfaces and actually lead to a much wider infection of the peritoneum than would occur if they were not used. When the abscess is open, the conditions of intra-abdominal pressure are such that the pus is forced toward the incision and despite appearances, much less infection of the peritoneum is produced than occurs when the pus is rubbed into the surface by the gauze.

We removed the appendix in all cases. We appreciate that this is contrary to the advice of many surgeons, and recognize that when such removal entails prolonged search and extensive trauma it should not be done. However, when the appendix is readily found—and this is the case in the vast majority of cases—its removal can be quickly and safely accomplished without any added risk.

Removal of the appendix in the presence of abscess or peritonitis has been discredited because by the ordinary technic of freeing an adherent appendix completely, much time is consumed, troublesome hemorrhage is apt to occur, and the inflamed bowel may even be opened. If, however, what we may call the "submuscular technic" is employed, no matter how badly adherent the organ may be and no matter what its location, provided any part of it, base or tip, can be found, it can be removed in a few moments. The method consists in incising the serous and muscular coats of any portion of the appendix which can be found and of pulling out the tubular submucous coat through the incision so made. Once this is accomplished, the submucous coat and the mucosa through the entire length of the appendix can be pulled out, much the same as an angleworm can be pulled out of its hole. It is unnecessary to tie a single vessel. The base of the appendix is recognized by the increase in size of the submucous tube as the latter is pulled out.

For drainage material, we used entirely sheets of rubber. Whenever the cæcum was thickened and semi-gangrenous so that the danger of fecal fistula seemed imminent, we placed these rubber drains so as to form a complete cofferdam about the dangerous area. One central drain was usually employed, which was removed in twelve hours, thus making room for the escape of any pent-up exudate. Drainage of course was employed solely for the purpose of forming a tract for the discharge of the infected material from the walls of the abscess. Gauze, glass, or rubber tubes were never used.

The essentials of the post-operative treatment may be summarized as follows: (1) The administration of an adequate amount of fluid. (2) Morphia. (3) Starvation until peritonitis had subsided. (4) No cathartics. (5) Gastric lavage. (6) Frequent examination for pelvic and subphrenic abscesses.

We gave daily a quantity of fluid sufficient to keep the urine output for each twenty-four hours at 1000 c.c. or more. The water was given by mouth if well taken, otherwise by proctoclysis or by the intravenous route. For the very ill or moderately ill patients we prefer the latter method to all others. We have repeatedly administered as much as 1400 c.c. of normal saline at a time. Many of the patients with widespread peritonitis were given intravenously a litre of normal saline three times a day for five to seven days. The method entails less disturbance of the patient than any other method of administering fluid. In hundreds of administrations, we have yet to see a serious result. Certainly no such quantities of fluid can be administered by hypodermoclysis without producing a most distressing soreness of the patient's entire body. We employed proctoclysis whenever it could be carried out with-

out distressing the patient unduly. We feel that the administration of an adequate amount of fluid is the single most important part of the treatment. The circulatory failure in a great majority of instances is due to dehydration. The heart is a perfectly competent pump, but the circulation fails through lack of sufficient fluid to be kept moving.

The second important element of the treatment was the administration of morphine in quantities sufficient to keep the patient at rest mentally and physically. Morphine in our experience does not increase abdominal distention or diminish the excretion of urine. Nothing more rapidly exhausts the vital reserve of a patient than pain and worry.

The third important part of the treatment was starvation. It is best to withhold nourishment as long as there is any noteworthy distention or nausea. In a severe case of peritonitis this may mean starvation for a week to ten days. It is idle and harmful to attempt to feed a patient with paralytic ileus. Such prolonged starvation may produce an acidosis. Of late we have combated this by the administration intravenously of 2 per cent. glucose solution, combined with small doses—1 to 3 units of insulin.

We cannot overstate the importance of gastric lavage in the post-operative treatment of peritonitis. Unrecognized distention of the stomach may prove fatal in a few hours. In case of doubt always pass the stomach tube. It is necessary at times to pass it as often as every two hours.

The patients were watched carefully for the development of subphrenic or pelvic abscesses and these were drained in all cases as soon as discovered. A pelvic abscess should be suspected in every case of gangrenous appendicitis, and a rectal examination made as a routine both before operation and at intervals after operation not more than two days, as long as fever is present.

We have used the Fowler position in practically all cases. We are inclined to attribute the apparently beneficial effects of the sitting posture not to its supposed tendency to limit peritonitis to the lower part of the abdomen so much as to its beneficial action on the breathing and on the circulation. In fact, we have often seen patients who could not endure the recumbent posture, but who were entirely comfortable when allowed to sit upright. The sitting posture is absolutely life saving for very fleshy patients.

It is instructive to study the causes of death of the nineteen cases who died after operation. The following table gives this in brief form:

Peritonitis	11
Myocardial failure	1
Intestinal obstruction	2
Multiple liver abscesses	1
Pulmonary complications	2
Subphrenic abscess	1
Uræmia (man of 65)	1
	19

Let us consider first the cases who died of peritonitis. These may be divided into three groups.

Group 1.—There are five of the clinical histories which indicate early diagnosis and prompt treatment, but record a fatal result. This group includes one case not operated upon. In these cases we must assume that the infection is extremely virulent or that the patient's resistance is unusually low. These patients are sick only a short time and have a general septicæmia in addition to a general peritonitis. This can be proved by blood culture. The following is a typical case:

R. C., male, age twenty-eight, admitted with a complaint of severe abdominal pain. The patient had been unusually healthy, his only illnesses having been measles and pertussis in early childhood, and pneumonia at the age of fourteen. His present illness began twenty-four hours before admission with generalized abdominal pain, which shortly localized in the right iliac fossa, and vomiting. On admission the patient was in agonizing pain, and appeared somewhat dehydrated. Temperature was 103, pulse 100, respiration 22. His leucocyte count was 13,000. The patient was operated upon immediately and an abscess containing a gangrenous appendix and about 30 c.c. of foul pus was found. When the peritoneum was opened, several ounces of curdy fluid poured through the McBurney incision. The appendix was removed and the wound closed in the usual way about several rubber dam drains. While in the operating room the patient was given an intravenous injection of 800 c.c. of normal salt solution. On return to the ward his pulse was 120, but six hours later it had risen to 160 while the temperature was 104. The leucocyte count had dropped to 8300. The patient died in fourteen hours in spite of another intravenous injection of normal saline and the general supportive treatment usually employed in such cases. Blood withdrawn an hour before death contained the B. coli communis in pure culture.

Group 2.—The second group of fatal peritonitis cases is that in which purgation was employed before operation. All authorities emphasize the bad effects of cathartics in appendicitis. The violent purging if successfully obtained dehydrates the patient, weakens him, lowers his general resistance, and makes him a poor operative risk. The following case clearly illustrates the effects of such treatment.

H. C., girl, aged ten. The patient was sent to the hospital with the diagnosis of appendicitis. Her family and past personal history were negative with the exception of measles, chicken pox and mumps, which she had early in life. She was admitted to the hospital about seventy-two hours after the onset of her illness. She had been given several doses of castor oil, two compound cathartic pills, eight quarter grain calomel tablets, a dose of magnesium sulphate and several enemata. On admission she presented the typical picture of an advanced general peritonitis. The abdomen was rigid and immobile, and gave the physical signs of free fluid. The temperature was 102.8 F., pulse 165, and leucocyte count 16,000. The patient was operated upon immediately and died in about five hours.

Group 3.—The third group of peritonitis cases is that in which the bowel is unduly manipulated at operation. Four of our patients who died of peritonitis may probably with justice be placed in this group. Two of these cases were among those operated upon through a right rectus or midline incision. With this type of incision it is practically impossible to prevent extensive soiling of the peritoneum when an appendiceal abscess is drained.

Using the McBurney incision it is possible to open directly into the abscess, or at least into the area of infected peritoneum, to drain off the pus, and to remove the appendix without danger of spreading the infection.

It will be noted that peritonitis accounts for more than one-half the deaths in our series. Eight deaths occurred from such miscellaneous complications as myocardial failure, intestinal obstruction, multiple liver abscesses, pneumonia, subphrenic abscess and uræmia. In one case of intestinal obstruction, at a second operation performed eight days after the first, almost the entire small intestine was found in the pelvis with the loops densely adherent to one another and to the structures of the pelvis. Enterostomy was unavailing. The subphrenic abscess numbered in this list was discovered at autopsy. It covered the posterior surface of the liver and was draining through the McBurney incision. The appendix in this case was retrocæcal in location.

General Discussion.—Perhaps no phase of the treatment of acute appendicitis has been more debated than the proper time for operation. Our experience as given in this report throws some light on this matter. We operated invariably on admission in every case except four who were obviously in a dying condition. We are willing to grant that in some instances, *e.g.*, the two cases reported above, that operation is absolutely useless, since we are dealing with patients who are already overwhelmed by a general peritonitis and a general septicæmia. However, a careful study of the clinical history in the fatal cases, with the exceptions noted above, fails to show that the operation in any case even hastened the inevitably fatal outcome. Since all but 35 of the 205 pus cases had been sick for five days or more, the results here reported are a fair index of the mortality rate in the late stage of the disease. Granting for the sake of argument that if operation had been performed earlier there might have been more deaths from peritonitis, some at least of the eight deaths from miscellaneous causes could almost certainly have been prevented by an earlier operation.

When we consider what is taking place about a gangrenous appendix, we can hardly believe that its removal except in the very terminal stages of the disease could be other than beneficial. The pus is accumulating in most cases behind a thin layer of peritoneal adhesions. Through this frail barrier the pus escapes here and there as the tension gets too great. This escape of pus leads to the constant throwing out of new adhesions until the abscess reaches a great size. The adhesions alone place the patient's life in danger of intestinal obstruction and he is further exposed to venous thrombosis, embolism, and to a general septicæmia.

With proper preparation, the operative technic described above can be carried out in a comparatively short time—15 to 20 minutes—and it is certainly not dangerous. In the entire series there was no death on the table or short of several hours after operation. The operation advised does not lead to the spread of peritonitis.

Finally, we wish to emphasize the importance of optimism and a fight-to-the-last-ditch spirit on the part of the surgeon. A healthy young patient will withstand a whole lot of peritonitis if he is given plenty of fluid, if his strength is conserved, and if complications such as pelvic and subphrenic abscesses, and gastric distention are promptly diagnosed and treated.

SUMMARY AND CONCLUSIONS

(1) Appendicitis is probably the most important and frequent surgical disease. About 14,000 people die annually from it in the United States.

(2) A series of 262 consecutive cases of gangrenous appendicitis is reported. The death rate for the entire series was 7.2 per cent., the same for 205 cases complicated by abscess was 9.2 per cent.

(3) The pre-operative intravenous injection of normal saline solution is advocated as a treatment for all very sick patients.

(4) The advantages of the McBurney incision are pointed out.

(5) The expectant treatment of appendicitis is not advised.

(6) Removal of the appendix by the technic described does not increase the risks of operation in most cases.

(7) The post-operative treatment employed consisted in:

(*a*) The administration of plenty of fluid, by the intravenous route, if water could not be taken by mouth.

(*b*) Sufficient morphine.

(*c*) Starvation until peritonitis had completely subsided.

(*d*) No cathartics.

(*e*) Free use of gastric lavage.

(*f*) Frequent examination for secondary abscesses, and prompt drainage of the same.

(8) Peritonitis accounted for 11 of the 19 deaths which occurred in the series. The chief causes of peritonitis were purgation and extreme virulence of the infection.

(9) Certain virulent and rapidly fatal cases of appendicitis are complicated by a general septicæmia.

(10) Prompt diagnosis and early operation in appendicitis would decrease the mortality almost to the vanishing point.

LYMPHOID HYPERPLASIA OF THE APPENDIX IN CHILDREN ITS RELATION TO RECURRENT APPENDICITIS

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The purpose of this paper is to call attention to the frequency with which excessive lymphoid hyperplasia of the appendix in children produces symptoms simulating appendicitis, usually of the subacute or chronic recurrent type, and, also, at the same time to suggest the propriety of considering this condition a distinct clinical entity of sufficient importance to entitle it to a place as such among diseases of the appendix.

During a period of eight years, from January 1, 1916, to December 31, 1923, 340 children under twelve and one-half years of age were operated upon for acute appendicitis on the Children's Surgical Service at Bellevue Hospital, the records stating definitely that gross pathological lesions of acute inflammation were present in every case. During this same period, some fifty-five children were operated upon because of symptoms suggesting appendicitis, in which no gross pathological lesions of acute inflammation were found, and in this group the laboratory reports of forty-nine cases are available. Of these, five showed the presence of pinworms, three were reported as showing no noteworthy changes, two were reported as early exudative appendicitis, and two as early suppurative appendicitis. It is with the remaining cases of this group, thirty-seven in number, that this paper has to deal. Some of these were diagnosed as acute, the majority as subacute or chronic appendicitis, because the symptoms seemed less severe than the usual run of acute cases, recurring with more or less frequency, and were operated upon only to find what to all appearances was a normal appendix, with the exception of two, in which the position was retrocæcal. The only pathologic change visible, if pathologic it be, was the injection of the vessels of the peritoneal coat of the appendix and also some enlargement of the mesenteric lymph-nodes, particularly in the ileocolic angle, which was noted in some of the cases. Grossly the appendix itself was not rigid or thickened, it was free from adhesions, and there was no sign of a permanent kink or twist, nor were concretions present within the lumen. In a few appendices, there was slight clubbing at the tip.

These children were operated upon because of severe colicky pain, lasting for several hours to a day or more, and localizing itself in the right iliac region. This was associated with definite localized tenderness in nearly every case. The other symptoms of acute appendicitis, namely, spasm of the right rectus muscle, nausea and vomiting, fever and leucocytosis, were not constant. All of these appendices were sent to the laboratory and the pathological reports stated very definitely that no inflammatory changes were present, but that, in each and every one, there was a marked hyperplasia of the lymphoid tissue, with or without sclerosis of the interstitial tissues of the submucosa. In a

few of the older children who gave a history of many previous attacks, this sclerosis of the interstitial tissues predominated, and was associated with atrophy of the appendix.

In other words, among the children operated upon with a diagnosis of appendicitis during a period of eight years, a little less than ten per cent. showed no evidence of inflammatory change in the appendix whatsoever, but all of them did show definite and constant microscopic changes involving the lymphoid follicles with which this organ in the young is richly endowed.

It must be remembered that a striking feature of the structure of the appendix is the quantity of lymphoid tissue in its walls. It has been compared to a Peyer's patch thrust out from the bowel like the finger of a glove, and is sometimes referred to as the abdominal tonsil. Numerous lymphoid follicles may be seen in serial sections of a normal appendix lying in the mucosa or even in the submucous layer. These resemble the solitary and agminated glands in other parts of the intestinal tract, but, in comparison with the size of the appendix, they are relatively much more numerous. It is said that an appendix three and one-half inches long contains from 150 to 200, or more, such follicles. This lymphoid tissue reaches its height of development in late childhood or adolescence, and, from then on, its tendency is to undergo involutional changes resulting in sclerosis and atrophy.

Six years ago, in a paper entitled "Lymphatic Disease in Children Simulating Appendicitis," Barss[1] reported from the hospital of the University of Michigan seven cases where appendices in children under fourteen years of age had been removed because of definite symptoms of appendiceal disturbance of a subacute nature. In none of these appendices did the microscope reveal any inflammatory changes, but in all there was a marked hyperplasia of the lymphoid tissue, the pathologist stating that the microscopic appearance of the lymphoid tissue in two of the removed appendices would suggest the possibility of lymphatism. These children were operated upon because of severe colicky pain and localized tenderness in the right iliac region. Each patient complained of nausea and most of them of vomiting, but in no case was there marked spasm of the right rectus muscle, and in none was fever present, nor was there a leucocytosis. Both headache and constipation occurred in nearly every case. In three cases it was observed that the mesenteric lymph-nodes were considerably enlarged.

In this paper, Barss called attention to the fact that the appendiceal symptoms were accompanied with changes in the lymphoid tissue of the appendix, these changes being similar to those which are regularly found in lymphoid tissue, wherever situated, in subjects of status lymphaticus.

Five years ago, Symmers and Greenberg,[2] reporting from the pathological

[1] Barss, Harold de B.: Lymphatic Disease in Children Simulating Appendicitis. Am. J. Dis. Child., vol. xv, p. 421 (June), 1918.

[2] Symmers, Douglas, and Greenberg, Morris: The Clinical Significance of Lymphoid Hyperplasia of the Appendix. Journ. A. M. A., Feb. 15, 1919, vol. lxxii, pp. 468–470.

laboratory of Bellevue Hospital, called attention to the great frequency with which appendices removed at operation on patients, especially under the age of thirty years, revealed no microscopic alterations other than lymphoid hyperplasia, with or without the association of moderate sclerotic changes in the connective tissue. They stated that in the pathological records at Bellevue Hospital, which include the results of the microscopic examination of several thousand appendices, the occurrence of excessive lymphoid hyperplasia was described as the sole, or the predominant change in about ten per cent. of the total number. There was no sign of inflammatory exudation present, and yet all of the patients had been subjected to operation because of definite symptoms of appendiceal disturbance. In analyzing twenty of the clinical histories of cases whose appendices showed this condition, they found that these patients complained of attacks recurring at intervals of weeks or months, characterized by cramp-like pains or by pain and moderate tenderness in the right iliac region lasting for several hours or days. Muscular rigidity was either very slight or not present. Nausea was common but vomiting rarely occurred. The temperature was normal in every instance, and the pulse rarely exceeded eighty or ninety beats to the minute. Headache and constipation were fairly common. The average age of these twenty cases was seventeen and one-half years. In every case operation was followed by recovery.

They described these appendices as presenting no gross or microscopic changes indicative of inflammation. Some appeared slightly enlarged, the majority were normal in size. There was some congestion of the vessels of the serosa. The lumen was diminished in size or even occluded. The mucosa was thickened and swollen. Microscopically these appendices showed hyperplasia of the lymphoid follicles attended with degenerative or necrotic lesions in the germinal areas, with or without sclerosis of the interstitial tissues of the submucosa. They described also an appendix occurring oftenest in older patients which was diminished in size, sometimes reduced to a cord-like structure, which, on microscopic examination, showed almost complete connective-tissue replacement of the mucosa and obliteration of its lumen. These authors believe that the degenerative changes found in the lymphoid tissue of these appendices is best explained as a histological evidence of status lymphaticus. At the same time they pointed out that there is a clinically recognizable syndrome referable to lymphoid hyperplasia of the appendix.

Of the thirty-seven cases which form the basis of this report, twenty-two were girls and fifteen were boys, which is interesting in that it shows a sex incidence quite the reverse of that which occurs in acute appendicitis in children, in which year after year our records have shown a preponderance of males over females, almost in the ratio of two to one. Because of the age limit of this service, not one of our children was more than twelve and one-half years old, but it is significant that twenty-two, or sixty per cent., had passed their tenth birthday, which would lead one to suspect that the condition becomes more frequent as adolescence is approached. Our youngest patient was a child five and one-half years old.

All gave a history of colicky pain, more or less severe, and often intermittent, usually starting about the umbilicus, and later localizing in the right iliac region. Many of the histories lay especial stress on the severity of this pain, describing it as sharp, stabbing, knife-like, or cramp-like, the patients often being doubled up because of its intensity. This appendicular colic, for that is what it really is, lasts for periods varying from fifteen or twenty minutes to several hours or more. The increase and swelling of the lymphoid elements, together with the inelasticity of the peritoneal sheath of the appendix, as pointed out by Morris some years ago, is the most likely explanation of this pain. These colicky attacks are often described as intermittent, occurring several times every day, or once or twice every twenty-four hours for a period of days, during the periods of remission the child appearing quite well, and even going out into the street to resume its play. Thirty children gave a history of repeated attacks occurring at varying intervals and dating backward over a period of weeks, months, or years. A history of severe, colicky pain, localizing in the right iliac region, recurring from time to time, is probably the most characteristic feature of lymphoid hyperplasia of the appendix, and suggesting, as it does, what is generally known as recurrent appendicitis, it is a fact of considerable significance that of our 340 children with definite acute appendicitis, not over three per cent. gave a history of previous attacks.

Twenty-four vomited with the present attack. This vomiting was generally repeated one or more times, and in several it preceded the colicky pain by several hours. Nausea as a symptom, independent of vomiting, was recorded but once.

There was some degree of tenderness or sensitiveness in every one of these patients. In six, it was recorded as marked, and in the remainder as moderate or slight. Rigidity, on the other hand, was recorded as marked in but three children: nineteen had no rigidity whatsoever, and of the remaining fifteen, muscular spasm was said to be either slight or very moderate.

In the articles concerning lymphoid hyperplasia of the appendix, both of Barss, and of Symmers and Greenberg, already mentioned, it is stated that fever was absent in every case, and that there was very little, if any, increase in the white cell count. This has not been true in our cases, for a rectal temperature of more than 100° was present on admission to the hospital in fourteen children, the highest temperature being 102.6° in a girl twelve years old. These temperatures rapidly subsided as soon as the children were put to bed, and were probably due to causes outside of the appendix.

The white cell count was recorded in twenty-nine cases. One child, a girl of eleven, had a leucocytosis of 15,000. Six children had a leucocytosis between 12,000 and 14,000. For years past we have adopted for our own use the more or less arbitrary standard that in children all counts below 12,000 are normal, and that counts between 12,000 and 14,000 represent a moderate leucocytosis and are of no especial significance. The average leucocyte count in these twenty-nine cases was 10,700.

Constipation was the rule, but two children suffered from diarrhœa during the attacks. Headache was mentioned as a prominent symptom in five cases. Some degree of enlargement of the cervical lymphatic glands was present in the majority of these children. General superficial lymphatic adenopathy was recorded in but one case. The mesenteric lymph-nodes are recorded as enlarged in five cases. The glands in the ileocolic angle are the ones usually seen, and therefore mentioned, but in one it was demonstrated that the lymph-glands of the entire mesentery were enlarged. In one child, the glands could be palpated through the abdominal wall and were mistaken for a localized appendicular abscess. The microscopic examination of these lymph-nodes showed simple hyperplasia. Hypertrophy of the tonsils was noted in sixteen of the children, and in six others the tonsils had been removed at some time prior to their coming to the hospital. In no case was the spleen enlarged, and there was no record as to the condition of the thymus gland.

I have gone into the symptoms at some length, and at the risk of being considered unnecessarily prolix, but, in so doing, I have tried to show just how these cases differed in their symptomatology from those of acute inflammation of the appendix, and whether clinically they could be so distinguished.

The following brief extracts from the histories of some of these patients, which have been selected without regard to any particular point except that they have been followed up for a period of six months or more following operation, show better than anything else the clinical picture presented by these children.

Case I.—Female, six and one-half years old, admitted March, 1917. One year before child was in the hospital because of severe pain in right iliac region accompanied by vomiting. She was kept in the hospital for two weeks under observation, and then allowed to go home. For the past six weeks child has had pain which comes on almost daily. She cries when she has this pain, rubs her hand over the lower right side of her abdomen. She has not vomited during this attack. She is constipated. Her appetite is good, and she has not been confined to her bed. Temperature on admission 100.3°, pulse 100. Leucocytes 13,400, polymorphonuclears 54 per cent. Urine negative. Examination shows that there is no muscular rigidity and but slight tenderness over McBurney's point. Provisional diagnosis—chronic appendicitis. Pathological report No. 2857: Marked lymphoid hyperplasia. No return of abdominal symptoms at the end of fifteen months.

Case II.—Male, age eleven, admitted March 30, 1917. This boy has had abdominal pain off and on for the past three months. This pain is sharp and colicky, and is located just to the right of the umbilicus. He has not vomited and he is not constipated. His temperature is 98°, pulse 72. Leucocytes 14,400; polymorphonuclears 76 per cent. Urine negative. There is some tenderness on pressure over the right iliac region, but muscular rigidity is not present. Provisional diagnosis—chronic appendicitis. Pathological report No. 2977: Lymphoid hyperplasia of the appendix. No return of symptoms after six months.

Case III.—Female, age twelve, admitted January, 1920. For a number of years has had attacks of general pain in abdomen associated with nausea, vomiting, and headache, occurring every two or three weeks. For the past year she has been having attacks of pain in abdomen in the region of the umbilicus. Sometimes she is nauseated, and sometimes she vomits. Frequently she belches gas. Present attack began twenty-four hours ago. She was seen by a doctor at her home, who made a diagnosis of acute appendicitis. On admission, it was noted that the child looked acutely ill, her tempera-

ture being 102.6°, her pulse 126. There is no record of the blood count. Physical signs negative, except slight rigidity over lower right quadrant of the abdomen, with considerable tenderness on pressure. Provisional diagnosis—acute exacerbation of a chronic appendicitis. Pathological report No. 53: Lymphoid hyperplasia of the appendix with sclerosis. No return of symptoms at the end of eight months.

CASE IV.—Male, age eleven, admitted February 17, 1920. Two weeks ago this boy had a sudden pain in the right side which doubled him up. This attack lasted two days. On the third day he got out of bed, but still had slight pain in his right side which has been continuous. Once or twice a day he gets an attack of cramps, which causes him to go to bed while it lasts. These attacks come on every day. His bowels are constipated. On admission, his temperature was 98°. Leucocytes 9400. Provisional diagnosis—subacute appendicitis. Pathological report No. 13,181: Lymphoid hyperplasia with slight sclerosis. No return of symptoms at the end of eight months.

CASE V.—Male, age eleven, admitted April, 1920. For the past four years has had recurrent attacks of pain and soreness in right lower quadrant. These attacks last one or two days. They are not accompanied by vomiting. The patient is obstinately constipated. Present attack began six days ago. There is pain in right lower quadrant with very slight rigidity and tenderness on deep pressure. Leucocytes are 9800. Temperature on admission 99°, pulse 84. Provisional diagnosis—chronic appendicitis. Pathological report No. 3325: Lymphoid hyperplasia of the appendix. No return of symptoms at the end of ten months.

CASE VI.—Male, age nine, admitted August, 1920. Severe abdominal pain, intermittent in character for past three days, with vomiting, fever, and headaches. He is constipated. There is little or no rigidity, and tenderness only on deep pressure. Temperature 102.2°. Leucocytes 10,800. Pathological report No. 6329: Marked lymphoid hyperplasia of appendix, with sclerosis. No return of symptoms at the end of two years.

CASE VII.—Female, age ten, admitted October, 1922. About one and one-half years ago had first attack, sudden in onset, of very severe, cramp-like pain in right side, which doubled her up. This lasted about ten minutes. She did not vomit. About one week later had another similar attack. During the next six months had about one attack every week. For the past year has had about one attack a month. Recent attacks have been accompanied by vomiting. She is not constipated, and there are no urinary symptoms. She was referred to the hospital with a diagnosis of chronic appendicitis. Her temperature on admission was 100.4°, her pulse 108. No blood count was recorded. Physical examination was negative with the exception of slight tenderness on pressure at McBurney's point, with no muscular rigidity. At operation the vessels of the appendix were found slightly injected, and the mesenteric lymph-nodes enlarged. Pathological report No. 11,583: Lymphoid hyperplasia of the appendix. Hyperplasia of mesenteric lymph-nodes. No return of symptoms at the end of eight months.

CASE VIII.—Female, age twelve, admitted December, 1922. Present illness has lasted off and on for about one year, with attacks of pain localizing in the right lower quadrant. This pain is sharp, knife-like in character, and more or less constant. It is more severe in the morning, with a few hours of relief during the day. There is no rigidity, and tenderness can be elicited only on deep pressure. Provisional diagnosis—chronic appendicitis. Pathological report No. 14,087: Lymphoid hyperplasia of appendix. No return of symptoms at the end of fourteen months.

It may be said that the majority of these children presented a very typical picture, recognized by repeated attacks of appendicular colic, attended with moderate local tenderness and little or no muscular rigidity, occurring at intervals of days, weeks, or months. It was often associated with obstinate constipation, and with nausea and vomiting, also with headache, but is not, as a rule, accompanied by noteworthy changes in temperature or blood count.

In that small number of cases where muscular rigidity, temperature, and leucocytosis are sufficient to suggest an underlying inflammation, some difficulty may be experienced in distinguishing between this and an acute appendicitis; nor do I see that any useful purpose is being served in making any distinction under such circumstances, for, after all, the treatment of both conditions is the same.

All of these children were improved by operation. Ether was administered in every instance, and there is no record of any difficulty in connection with the anæsthetic. In every case, the post-operative recovery was prompt and without complication, with the exception of two in whom a post-operative bronchopneumonia delayed convalescence for a few days.

Following operation, thirty-one children were followed up for periods varying from three months to six years. Two of these continued to have occasional attacks of cramps following indiscretions in diet, but the remainder were quite free from abdominal symptoms. In fact, one of the most striking features of this condition was the way children who had been having attacks every few weeks for months, and even years, were completely and permanently relieved of their symptoms following removal of the appendix.

The question naturally arises as to the nature of this condition. With the exception of the two articles already quoted, there has been very little in recent literature concerning the clinical significance of lymphoid hyperplasia of the appendix. Eight years ago, Eli Moschcowitz,[3] in an article on the "Pathology of Appendicitis," stated that lymphoid hyperplasia of the appendix was rare, and, in his opinion, usually associated with a status lymphaticus. He mentions the fact that some authors have described it as pseudo appendicitis lymphatica. Among pathologists, more and more are taking the view that it is a condition peculiar to subjects of lymphatism. This latter belief is based on the fact that the degenerative lesions found in the germinal areas of the hyperplastic lymphoid follicles of the appendix are characteristic of lymphoid tissue wherever found in subjects of status lymphaticus, and it may be that this type of appendix is best explained as a local manifestation of this condition, remembering always that the modern conception of status lymphaticus connotes a type presenting certain stigmata and physical attributes possessed by a great number of individuals, some of whom are particularly susceptible to certain infections, and some few succumb even to the most trivial of injuries, but, on the other hand, there are many of these subjects, perhaps the majority, who are able to withstand not only various degrees of trauma, but infections as well.

While in our experience the symptom complex which these children present is completely and permanently removed without untoward result by operation, if it be a condition peculiar to subjects of status lymphaticus, the question may properly be raised whether or not those children who show marked and unmistakable evidences of the stigmata of this condition should be operated

[3] Moschcowitz, Eli: Pathology of Appendicitis. ANNALS OF SURGERY, vol. lxiii, p. 709, No. 6, June, 1916.

upon as a matter of routine, owing to the possible danger of sudden or unexpected death. This is a question each one must settle for himself, but it may be said with great positiveness that if there be in a given case any doubt as to whether the symptoms are those of acute appendicitis or those of lymphoid hyperplasia, the indication to operate is plain, for it may be accepted as a truism that the actual danger of an unoperated acute appendicitis is far more real than is the potential danger of a status lymphaticus.

In conclusion, it may be said that so-called subacute or chronic appendicitis, usually of the recurrent type, occurs in approximately ten per cent. of children with appendiceal symptoms. In the great majority of these cases the symptoms are due not to an inflammation of the appendix, but to excessive hyperplasia of the lymphoid tissue in its walls, which symptoms are promptly and permanently relieved by removal of the appendix. Furthermore, as the majority of these cases conform to a recognizable syndrome, lymphoid hyperplasia should be considered as a clinical entity among diseases of the appendix.

TUMOR OF THE OVARY WITH TWISTED PEDICLE, OCCURRING IN A CHILD TWO AND A HALF YEARS OF AGE

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Attention has been called a number of times in the literature of ovarian tumors in children to the report of Wiel, 1905,[1] showing 62 ovarian tumors in children under the age of ten, and 24 under the age of five years. This covered a most extensive study of statistics and was the outgrowth of interest developed in a patient five years of age operated on by Dr. Howard Kelly. Since this time, subsequent single case reports have been made and it is pointed out by Downes [2] that a careful pathological analysis of the tumors showed that 62 per cent. are classified as malignant as against a 32 per cent. in the series of Wiel. Downes explains this discrepancy upon the basis that probably a more careful microscopical examination of the multiple sections had been made in the later series. Nothing further has been contributed than that a great many so-called simple cysts have been found upon careful examination to be dermoids. The most recent report is by Dr. Von W. Mittelstaedt,[3] in which he merely records an ovarion tumor but does not specify the pathology or bring out any new discussion. An early case was reported in 1886 by Carmaby and Howard, of a child, twelve years of age, which was very similar to the one now being reported. The outstanding features being acute abdominal pain and toxæmia, simulating appendicitis.

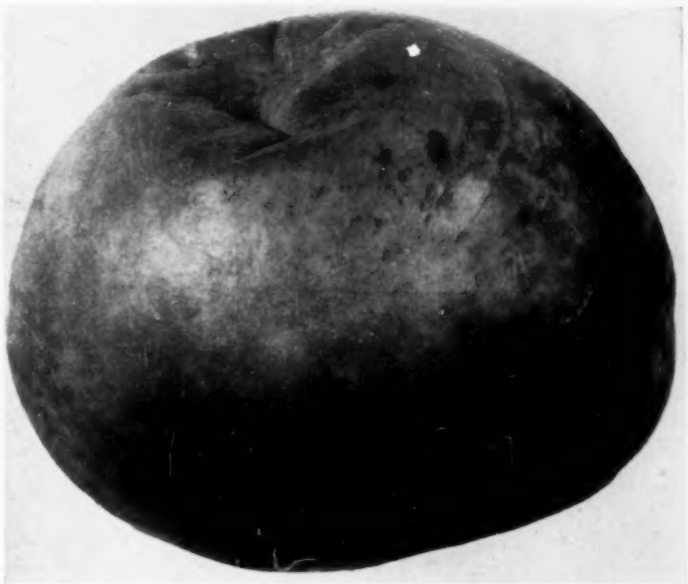

Fig. 1.—Gross specimen. Shows a comparatively smooth surface with darker mottled areas representing the hemorrhage into the wall.

The particular interest in the case I have to report is from a clinical standpoint. Three years previous to the operation an uncle of the patient had an acute attack of appendicitis; the appendix ruptured and was subsequently

operated upon. The course of the disease was so impressed upon the minds of the parents of this child that when acute symptoms developed they made a diagnosis of acute appendicitis with probable abscess formation and called in a local practitioner who confirmed the diagnosis, and upon their own initiative called in a surgeon.

CASE REPORT.—In an Illinois hospital a baby girl, two and a half years old, was admitted on the third day of an abdominal condition. She was well developed. Her history was negative up to a few months before, when she had several recurrent attacks of pain in the right side accompanied by vomiting and recovery within two or three days. The present attack began exactly as the preceding attacks; but the pain and tenderness in the right side progressively increased in severity, with gradually increasing temperature and pulse rate. On the third day marked signs of sepsis appeared, with a distinct swelling in the right side.

FIG. 2.—Another view of the gross specimen showing the ovary and a portion of the tube, outer two-thirds. The main ovarian tissue is seen as the lighter structure.

Physical Examination.—Pulse 130. Temperature 102.6. Respiration very rapid. The child was very irritable and apparently very toxic. The knees were flexed upon the abdomen and on palpation the abdominal muscles were found to be decidedly spastic. A large mass could be made out in right lower quadrant, causing a definite enlargement of that side of the abdomen. Unable to obtain a blood count.

Rectal Examination.—Outlines of a large mass appeared in the right lower quadrant which had a very smooth, rounded surface, not typical of an appendiceal abscess yet very suggestive. This mass was unable to be moved by digital manipulation. No inflammatory reaction or enlargement about the uterus or vaginal tract was apparent. No attempt was made at vaginal examination.

Operation Under Ether Anæsthesia.—Upon gentle palpation with relaxed abdominal muscles the tumor mass changed in position from the right lower quadrant to a position higher and nearer to the umbilicus. This definitely changed the diagnosis from one of appendicitis with abscess formation to one of a tumor. Right rectus incision was made and a small quantity of blood-tinged fluid escaped. A tumor mass the size of the fist of a mottled, reddish and bluish color was found, originating in the right ovary and attached to a pedicle which was sharply twisted at the junction of the ovary with the Fallopian tube. It was necessary to sacrifice the distal third of the tube as the extremity was completely involved with the tumor mass. The abdomen was closed with No. 1 catgut without drainage and fine silk was used for the skin. The child made an uneventful

ful recovery and was discharged from the hospital in two weeks. There have been no further complications to date.

Pathology.—Laboratory No. 3432. Laboratory diagnosis,* dermoid cyst of ovary with hemorrhage. *Gross Description.*—Specimen is a cyst measuring 8 x 6 x 7 cm. At one point there is an area about 4 x 3 cm., which is grayish-white in color and from the surface of which protrudes a small remnant of tube and a portion of the ovary measuring 2 x 1 cm. There is marked discoloration over the entire tumor and it appears very thin-walled except immediately surrounding the previously described area and a few

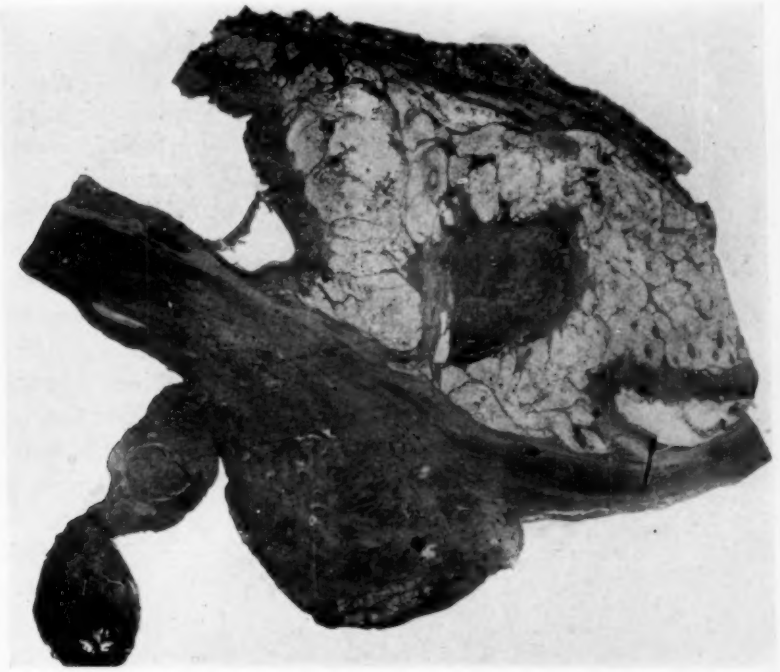

FIG. 3.—The upper portion shows blood and sebaceous material adjoining the inner lining of the tumor. The intermediate portion represented by the lighter area is chiefly adipose tissue. The more compact tissue below represents ovarian stroma but no follicles are present. The thinner strand of tissue represents the mesosalpinx and in the lowermost portion the tube lumen can be seen.

centimetres beyond this. On opening the cavity it is found to be filled with a bloody, turbid fluid which is a thin liquid. The entire cavity is coated with a coagulated material, chiefly blood. The inner stalk of the tumor seems to be directly over the area occupied by the ovary. Over this area there is a considerable amount of thick sebaceous material and a small amount of hair. Sections taken through the area overlying the ovarian tissue.

Microscopic.—Sections of the tumor wall show a great deal of hemorrhage between the fibrous tissue strands. No ovarian tissue recognized. The cavity is lined by squamous epithelium and there are numerous hair follicles beneath the epithelium. No sebaceous glands seen in sections studied. There is no evidence of malignancy. There is also a considerable amount of adipose tissue in the periphery of the wall of the tumor. In the outer half of the wall the blood-vessels are markedly dilated. There is no evidence of thrombus formation however. There is considerable infiltration with polymorphonuclear leucocytes in the more peripheral portion of the wall.

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Diagnosis.—Teratoma of ovary. Simple dermoid cyst. Hemorrhage into wall due to twisting of pedicle.

Discussion of Operation.—Children and young infants stand ether anæsthesia very well, in fact, it has long been the anæsthetic of choice for children as well as for adults. The reason for this comment is that one often finds that chloroform is still used in children. A number of abdominal operations have been successful at the St. Louis Children's Hospital under local anæsthesia, particularly a large series for pyloric stenosis. The suckling child is quieted by being given a nipple or a pacifier throughout the operation under a local anæsthetic.

FIG. 4.—Inner portion of the wall of the tumor. Wall is markedly infiltrated with blood which obscures its structure. Squamous epithelium is well seen at the top. In the lower half of the picture are seen numerous small hair follicles. Note a small amount of adipose tissue.

The most annoying complication during the operation is the sudden forcing out of the intestines through the abdominal incision. The replacing of intestines invariably prolongs the operation and is a decided factor in the production of shock. In pyloric cases this happens only about once in ten cases.

Comments.—This case only further emphasizes the great similarity of symptoms between acute appendicitis and ovarian tumor with twisted pedicle. In both, nauseau and vomiting are common symptoms, also abdominal cramps and localized pain in the right side. Unless the case is seen early in the attack or the abdominal tumor has been previously noted, the diagnosis would be very difficult to make and can only positively be made upon the rectal examination. This further emphasizes the extreme importance of rectal examination

in all acute abdominal conditions in children. It does not seem that a vaginal examination would be of any help, except in such cases as had a vaginal discharge where a malignancy involving the vagina or cervix were considered, but certainly not as a diagnosis of an intra-abdominal lesion.

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ANEURISMS OF THE ILIAC AND FEMORAL ARTERIES

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In the spring of 1923, within a short period of a few months, three cases of aneurism of the iliac and femoral arteries of unusual interest were operated on in the John Sealy Hospital, surgical clinic. One was a traumatic arteriovenous aneurism of the femoral vessels in the middle portion of the femoral (Hunter's) canal in which both femoral artery and the terminal branch of the profunda femoris communicated directly with the femoral vein by separate fistulous openings. Another was a spontaneous aneurism of the external iliac artery and the upper portion of the femoral which was completely consolidated proximally but open distally from the origin of the profunda. The third was a spontaneous aneurism of the distal portion of the common iliac artery and the whole length of the external iliac trunk, in which ligature of the common iliac trunk six months previously had failed to effect a cure. The method of treatment was radically different in each of the cases.

The following case reports are presented with brief comments in the hope of adding a little to our rapidly growing knowledge of arterial surgery:

Case I.—*Arteriovenous fistula between the femoral artery and vein treated by ligature of the artery proximally and distal to the anastomostic opening.* E. S., male, colored, aged thirty-nine, hospital No. 132,182. The patient was admitted to the John Sealy Hospital, November 8, 1922, for treatment of ulcers of the left leg which were thought to be syphilitic. He was found to have an aneurismal varix affecting the left femoral artery in the middle third of the thigh. After a month's rest in hospital he was discharged. He was readmitted January 16, 1923, for operation on the aneurism.

Past History.—He contracted gonorrhœa eight years ago, and a venereal sore, probably syphilitic, five years ago. Three years ago was shot through the middle of the left thigh with a No. 38 bullet, which penetrated the limb from the medial to the lateral side, producing an open comminuted fracture of the femur. The fracture was plated through a long incision on the lateral side of the thigh. Union was satisfactory and the plate stayed *in situ* without causing any trouble. Soon after getting up on crutches he noticed a fulness and pulsation on the inner side of the thigh near the healed bullet wound, and complained of a beating and vibration in the affected limb. He never regained full use of the leg. It remained thinner and weaker than the sound one. The circulation was very defective. The skin remained dry and lost its elasticity. Superficial ulcers were constantly appearing without adequate cause.

Present Illness.—A few months ago several ulcers appeared spontaneously over the shin bone and the front of the ankle. Since they showed no tendency to heal, while the patient walked about, he was admitted to the hospital wards.

Physical Examination.—The patient was fairly well nourished. He limped on his left leg. The whole leg from the groin down was much thinner than the sound leg. Below the knee the skin was rough, ichthyotic and inelastic. Several small indolent ulcers were present in the lower third, over the shin bone, and over the front of the ankle. The granulations on the ulcerated surface were indolent and the discharge was scanty and inodorous. The circulation in the skin was very defective. Below the knee the whole leg was slightly swollen and œdematous. In the middle of the thigh on its medial

aspect one could see a small round scar caused by the entrance of the bullet. On the lateral aspect of the thigh there was a scar about five inches long over the site of the bone plate which had been used to fix the fractured femur. Bony union was firm and massive. On palpating the femoral vessels on the medial side of the limb, a vigorous thrill was felt. It was most intense in the neighborhood of the bullet wound, but was quite perceptible along the whole course of the femoral vein as high as the inguinal ligament. It was very indistinct in the popliteal space, and imperceptible in the tibial arteries at the ankle-joint. On auscultation along the line of the femoral vessels one could hear a loud "bruit." This also was most intense below over the bullet wound and diminished as one approached the heart. The bruit was faintly transmitted into both tibial arteries as far as the ankle. Traced proximally, it was very intense as far as the groin, was fainter in the iliac fossa, and fainter still over the vena cava inferior. It was quite distinct over the lower portion of the sternum and ensiform cartilage and over the right auricle. The quality of the bruit was characteristic. It had the continuous roaring sound like that of distinct machinery or of a train passing over a bridge, which is so characteristic of arteriovenous aneurism. The roaring sound was continuous during the whole cardiac cycle. It reached its maximum intensity at the height of each pulse wave and faded gradually in the intervals. The femoral artery was uniformly dilated to twice its normal size from the inguinal ligament to the level of the fistula. At the level of the fistula the dilatation was greatest. Below the fistula arterial pulsation was very feeble and the vessel was apparently smaller than normal. There was no suggestion of an aneurismal sac in any portion of the dilated artery. On applying carefully graduated pressure on the artery with the point of the forefinger over the site of injury both thrill and bruit disappeared. The proximal portion of the artery remained distended and continued to pulsate. Digital pressure on the femoral artery just below the inguinal ligament stopped both thrill and bruit. Examination of the heart showed no evidence of enlargement or of dilatation or hypertrophy. Unfortunately no examination was made to determine the Branham brachycardiac phenomenon.

A diagnosis of aneurismal varix was made. Everything pointed to the absence of an aneurismal sac and to the presence of a direct opening between the femoral artery and vein. The absence of pulsation in the artery below the wound and the feeble circulation in the leg showed that most of the arterial blood from the femoral artery was passing through the opening into the femoral vein, and thence proximally towards the heart. The transmission of the loud bruit upwards towards the right side of the heart corroborated this view. The circulation of blood through the leg in the parts supplied by the femoral artery distal to the lesion was so feeble that we felt certain that very little blood was passing along the distal portion of the vessel. The efficiency of the collateral circulation was a matter of surmise. It was reasonable to believe that the plating operation had injured the descending branches of the lateral circumflex vessels considerably, but we had no accurate means of finding out how much damage the terminal branches of the profunda femoris and the perforating arteries had received by the passage of the bullet. It was, therefore, necessary to test the efficiency of the collateral circulation before attempting an operation which might cut off the direct circulation completely. This was done in the following manner: The whole limb was rendered bloodless by bandaging it firmly with a rubber bandage from the toes to the groin. An Esmarch tourniquet was then wound around the thigh, above the limit of the rubber bandage, tight enough to prevent any arterial blood from entering the limb. The rubber bandage was then removed, but the Esmarch tourniquet left in place. Pressure was then made on the femoral artery below the origin of the profunda femoris by a special tourniquet made after a pattern described by Matas as the "Massachusett's Hospital tourniquet" (A Carte tourniquet would serve the purpose). By means of this instrument the femoral vessels were compressed against the femur, but no pressure was brought to bear on the terminal branches of the profunda femoris. As soon as the pad of this tourniquet was in place, the Esmarch tourniquet was removed from the upper part of the thigh, and

circulation was restored in the femoral and profunda trunks. As blood could only pass into the leg through the profunda artery alone and its anastomoses with the geniculate and arteria genu suprema below, the restoration of circulation, which was shown by the gradual descent of a red blush, was proof that the collateral channels were patent and adequate.

Tests were made on several occasions on separate days under the following conditions: In one set of tests, pressure was made on the femoral artery proximal to the fistula; in the other, pressure was made directly on the fistula. In the former the circulation was restored without a halt in less than a minute. In the latter the return of circulation was very slow. At the end of three minutes the toenails began to show some color; but even at the end of ten minutes the circulation was very feeble. The quick return of blood to the leg and toes proved that it was safe to arrest the circulation in the femoral artery at any point between the origin of the profunda and the opening into the vein; but the slow imperfect return when the site of anastomosis was compressed showed two facts conclusively, (1) that the collateral arterial trunks derived from the termination of the profunda femoris were very closely applied to or incorporated with the aneurismal varix, and (2) that their integrity and patency were essential to the life of the limb if by any chance the main trunk of the femoral artery should be occluded. While absolute proof was impossible, we were very suspicious that the profunda femoris opened into the femoral vein and participated in the arteriovenous anastomosis.

Operation, (January 26, 1923), gas-ether. A long incision was made through which the femoral artery was exposed from a point just below the origin of the profunda femoris to the lower end of the adductor canal. The femoral artery proximal to the opening into the vein was dilated to twice its normal size and pulsated vigorously. Distal to the opening it was contracted and no pulsation was present. It was adherent to the vein for a distance of at least three-quarters of an inch, and the sides of the vessels were fused together so firmly that it was impossible to dissect them apart or to find a neck of communication. The artery was separated from its sheath at a point about an inch above and at another point about an inch below the fistula. Traction threads were carried around the vessel at these places to facilitate the application of the artery clamps. The vein was treated in a similar manner. The walls of the veins were thin and pulsation was very vigorous. The dissection of the veins was difficult and tedious. A rubber-covered clamp was then placed on the artery proximal to the opening. Pulsation and thrill ceased in both parts of the veins. Another clamp was placed on the distal portion of the artery without producing any changes. Then the distal part of the vein was clamped without producing any change. Finally the proximal end of the vein was clamped. Immediately the site of the aneurismal varix between the clamp began to fill up slowly with blood until it became as large as a hen's egg. The distention was so great that I was afraid that the vein would burst, and to prevent such a catastrophe, the proximal clamp was loosened. The vein collapsed immediately. The manœuvre was repeated several times with identical results. The segment of vein became distended like a toy balloon and as far as we could make out, neither pulsation nor thrill could be detected. It was, nevertheless, clear that a fair-sized artery communicated with the segment of vein between the clamps and that the *arteriovenous fistula was double and not single.* The site of the main fistula was almost exactly in the middle of Hunter's canal, at which level the vein lies posterior to the artery. Exposure of the vein had been very difficult. Its posterior surface at the site of the fistula was firmly connected with the adductor longus muscle and there was great probability that any further attempt to liberate it would result in tearing its walls. The accessory fistulous opening was situated on its deep or posterior surface in a very inaccessible position. The artery opening into the vein in this situation could only be the terminal trunk of the profunda femoris or one of its branches. (Fig. 1.)

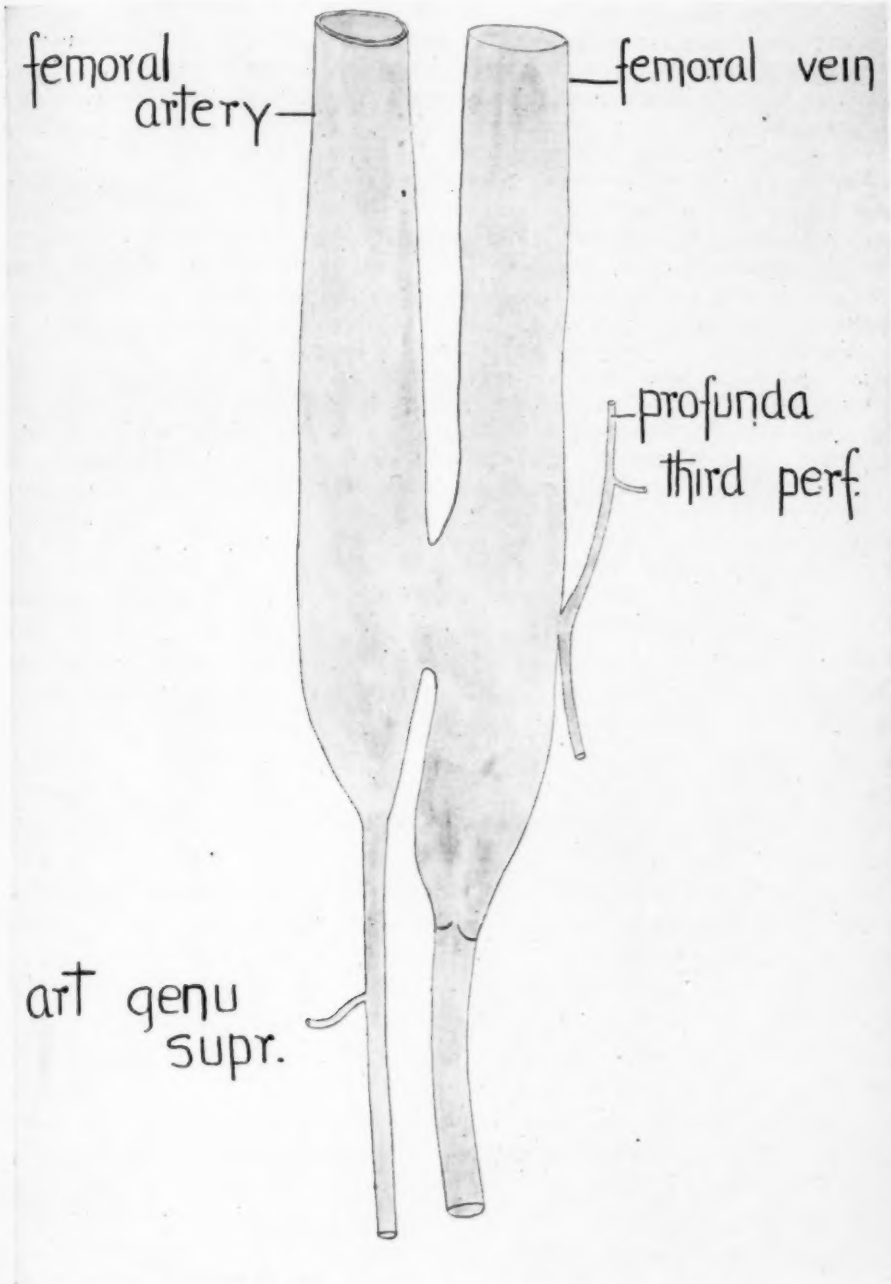

FIG. 1.—Arteriovenous fistula between the femoral artery and vein. The profunda artery is shown opening into the vein also. Note the small size of the artery distal to the fistula; also the competent valve in the vein distal to the fistula. (Case I.)

We were strongly tempted to control the arterial circulation in the profunda femoris, by placing a clamp on the femoral artery above its origin, and to continue with the operation, for our object had been to make a transvenous suture of fistulous opening into the artery according to the Matas-Bickham method. Considering, however, that the

collateral circulation through the branches of the lateral circumflex artery had been seriously damaged by the plating operation on the femur (Fig. 8) and that the tests of the efficiency of the collateral circulation showed that deep pressure over the site of the fistula seriously jeopardized the circulation of the limb, we concluded that it was very dangerous to run the risk of wounding the profunda femoris, because it was evidently the only really competent collateral channel. Consequently we abandoned the transvenous route and finished the operation by dividing the femoral artery between ligatures, proximal and distal to the fistulous opening. While placing the ligature on the distal end of the artery the origin of the arteria genu suprema was found arising from its trunk between the ligatures. It was secured and tied near its origin. We were somewhat worried over this at first, because we thought we had cut one of the important anastomotic channels. No bad effects, however, followed. The immediate result of the ligature and division of the main femoral trunk was very satisfactory. Pulsation in the vein stopped at once. We were not so certain about the thrill. An almost imperceptible vibration could be felt in the vein. The wound healed kindly. A few days after the operation an unmistakable thrill was felt at the site of the original trouble. It was, however, feeble in character and was heard very faintly in the groin. It showed no tendency to increase in intensity during the period the patient was kept under observation (four months). The circulation of the leg and foot was never embarrassed. Rapid improvement in nutrition was noticed at once. Œdema disappeared. The skin lost its dry character and became moist and supple. The ulcer healed up rapidly. When the patient was discharged from the hospital, two months after the operation, he was able to walk without discomfort.

Such a favorable result was unexpected. The operation was anatomically and physiologically incomplete, because we had failed to shut off every avenue of communication between the arterial and venous channels. Some arterial blood, we had no means of gauging how much, was still flowing into the femoral vein from the profunda femoris artery or one of its branches. We had succeeded in shutting off the communication between the femoral artery and vein, but nothing more.

A study of the physics of the circulation in the presence of an arteriovenous fistula shows that profound changes occur not only in the veins in the immediate neighborhood of the fistula, but in the arterial system proximal to the fistula and even in the heart itself. The heart frequently shows myocardial insufficiency with marked hypertrophy and dilatation. The artery proximal to the fistula is occasionally dilated to a huge size, the external iliac sometimes resembling the abdominal aorta (Halsted). The reasons for these changes are somewhat complex, but they probably arise primarily in the necessity for a higher blood-pressure in the part of the body supplied by the artery in which the fistulous opening has been made. Thus the leg in the case of a fistula between the femoral artery and vein is in sore need of blood, and a proper quantity cannot be obtained unless the volume flowing down the main femoral artery is large enough to fill the artery distal to the fistula, even though the greater part of it passes through the cut-off into the vein. Such an ideal condition probably never occurs. The limb is invariably badly served, but the physiological stimulus is constantly acting to bring the ideal conditions about. This entails, not alone hypertrophy of the left heart, but owing to the increased size of the arteries and the increased volume of blood reaching the heart

through the fistulous opening, it leads to an increase in size, of the heart chambers and frequently to dilatation. The local conditions are easier to understand. In the immediate neighborhood of the fistula the blood-pressure in the artery and vein is nearly equal. This increased venous pressure remains constant as far as the first set of distal valves which are competent. They close at once. In a proximal direction towards the heart the pressure decreases rapidly, because there is ample room for expansion in the highly distensible veins which carry the flow towards the heart. Towards the periphery, however, no blood can possibly pass through the valves in either direction. It is impossible for the blood-pressure to rise high enough on the distal side of the valves to force them, because it would presuppose that the venous circulation was under a higher tension than the arterial. It is also impossible for the valves to be forced from the proximal side, because that would mean the reversal of the circulation. Therefore, the blood peripheral to the valves is forced to make its way around the obstruction in a circuitous manner through the muscles and other tissues until it communicates with veins which open into the main vein away above the obstruction where the higher pressure has faded away and where it is possible for the venous blood to discharge itself into the general current. In the case of a fistula in the lower portion of the femoral vein the pressure at the opening of the profunda vein into the main trunk is probably low enough to allow the exit of blood without much difficulty. Under these conditions the blood in the femoral vein near the anastomosis would be purely arterial and there would be no mingling of arterial and venous streams until it reached the opening of the profunda vein into the main trunk. The embarrassment of the venous circulation would be relieved at once by closing the fistulous opening by any method, either by ligature of the artery above and below the opening (exclusion) or by direct suture of the edges of the fistula. The moment the blood-pressure dropped in the vein the valves would open and the flow of venous blood would follow its normal channels.

In the case reported, although a slight flow of arterial blood still passed directly into the vein, the blood-pressure did not reach such a high level as before and consequently the current of venous blood passing along the femoral vein was unobstructed.

Case II.—*Partially consolidated ilio-femoral aneurism extending distal to the origin of the profunda femoris. Excision of aneurism, including iliac and femoral veins. Cure.* Tom Thomas, male, colored, aged forty-three, was admitted to the John Sealy Hospital complaining of intense pain in the anterior surface of the right thigh. On examination an oblong tumor was found situated along the line of the external iliac and femoral arteries. It extended from a point about two inches above the inguinal ligament to the middle of Scarpa's triangle. The greater part of the mass was hard, nodular and homogenous. On its superficial surface several movable nodules, like lymph-nodes, could be palpated separately. It was firmly fixed to the deeper parts. The upper end passed posterior to the inguinal ligament. Neither pulsation, nor thrill nor bruit could be distinguished.

The history of the patient showed that he had formerly suffered from typhoid, malaria and rheumatism, and that he had contracted a chancre at the age of twenty-one, and gonorrhœa seven years ago. He was shot in the right buttock in 1916, and although

no wound of exit was found, the bullet could not be located. At the present time the Wassermann reaction is negative.

The swelling in the groin and the upper part of the thigh was noticed first about six months ago. Its increase in size has been gradual. Except for the pain along the cutaneous branches of the femoral nerve and slight œdema of the leg below the knee he suffers little.

Diagnosis.—At first the tumor was thought to be either an inflammatory or a malignant growth situated in lymphatic glands lying on the medial side of the femoral and external iliac veins. Later on we came to the conclusion that it was probably an aneurism which had become consolidated in the greater part of its extent. Its position along the line of the artery, complete absence of pulsation in the femoral artery below and in either tibial, neuralgia in the branches of the femoral nerve, uniform fusiform shape, very slow growth, and the absence of any source of infection to cause an adenitis were all in favor of such a conclusion.

My advice was to leave matters alone and to give potassium iodide and tonics internally. The patient persisted in his requests for operative removal under the plea that the pain was intolerable and that he was convinced that the growth of the tumor was progressive. I consented reluctantly.

Operation, (March 9, 1923). A vertical incision was made along the line of femoral and external iliac artery reaching from a point four inches above the inguinal ligament to the middle of thigh. The oblique abdominal muscles and the transversalis were divided and the upper portion of the external iliac artery was exposed by the retroperitoneal route. The external iliac vessels were exposed above the tumor and examined carefully. The artery was small and completely collapsed. No blood was passing through it. The vein was also small but on compression it was found to contain blood. Both vessels were traced to the upper end of the tumor with which they fused. The dissection was now carried into the upper part of the thigh. The femoral artery and vein were traced upwards to the lower pole of the tumor. Both were distended and apparently full of blood. It was evident that the collateral circulation had been established through the crucial anastomosis and that a considerable amount of blood was flowing up the profunda femoris into the main trunk and thence distally into the legs. We had no means of finding out how adequate the collateral circulation was through the terminal branch of the profunda femoris and whether the vitality of the limb would be imperilled if the reflux arterial current up the profunda into the femoral artery should be cut off. We felt that gangrene would inevitably follow if the posterior anastomoses were inefficient. After some hesitation we took the risk and excised the aneurism. The external iliac artery and vein were divided above between two ligatures. The aneurism with the vein closely incorporated in its wall was then dissected from the side of the pelvis without difficulty. As the dissection approached the inguinal ligament the femoral nerve came into view on the lateral side of the aneurism. It was retracted outwards and guarded carefully from injury during the dissection of the distal part of the tumor from the thigh. The deep circumflex iliac and inferior epigastric arteries did not bleed when they were cut. The dissection below the inguinal ligament was more difficult. The tumor was lifted up from the pectineus muscle and the external pudendal arteries divided between clamps. The medial aspect of the tumor was separated from the adductor brevis. The femoral artery and vein were then divided between two ligatures just below the lower end of the tumor and the lateral and posterior connections of the tumor isolated and divided. This part of the operation necessitated the division of the profunda femoris artery and vein. Both vessels were patent. After ligature of these trunks the wound was dry. (Fig. 2 is a sketch of the dissected aneurism.)

Feeling some anxiety about the peripheral circulation, the toes were examined and blood was seen to circulate around the bases of the nails.

The convalescence was without incident. The wound healed kindly. Circulation in the foot was never embarrassed and the limb was free from œdema. The patient was

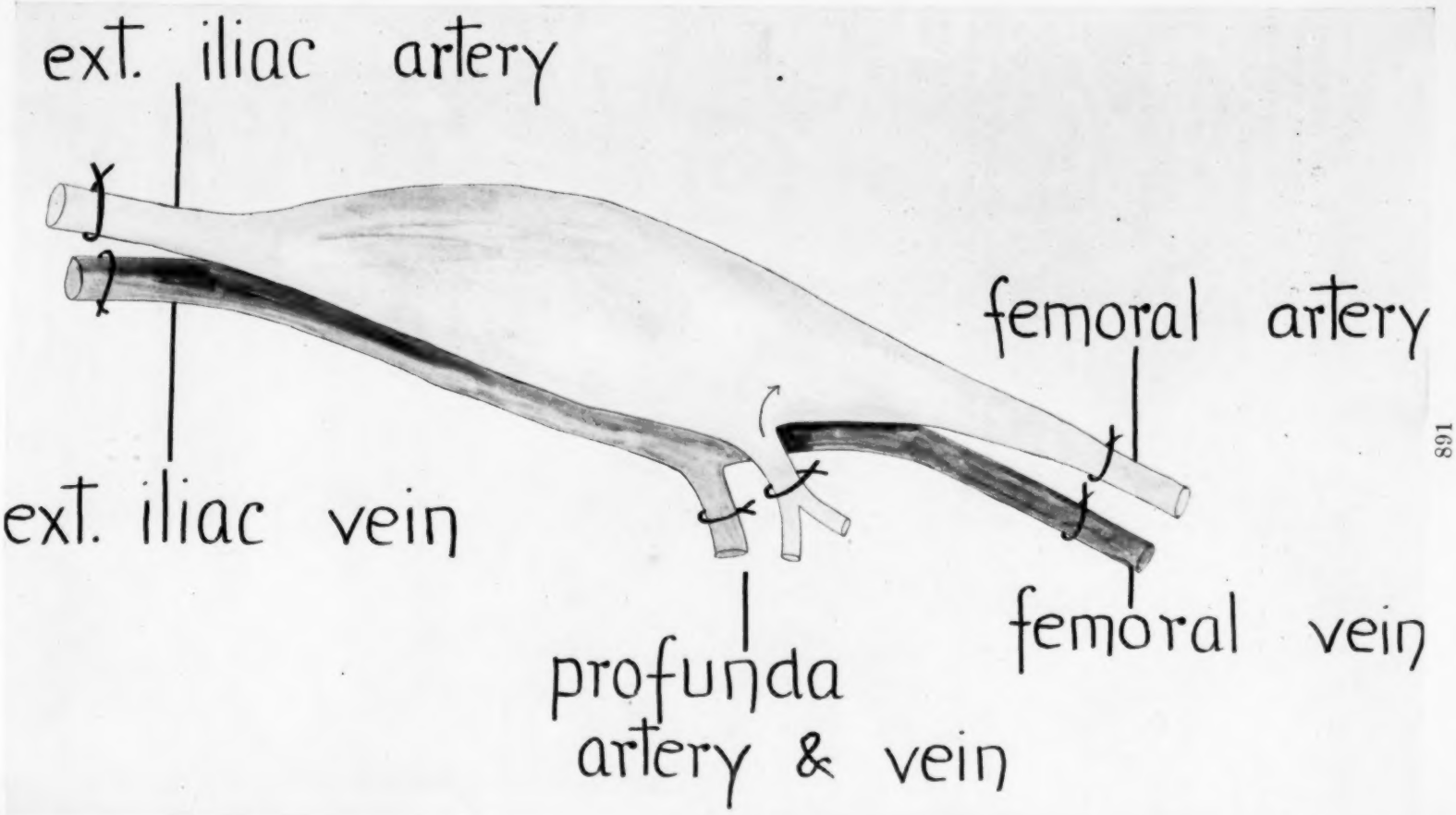

FIG. 2.—Rough sketch of the consolidated aneurism removed by excision in Case II. The distal portion of the aneurismal sac was not consolidated. Blood was circulating sluggishly (up-stream) along the profunda into the sac and thence distally along the femoral. The femoral vein was patent.

allowed to sit up during the third week, and in a short time the leg and foot became œdematous. In the recumbent posture the œdema disappeared, but it always returned when the patient stood upright. At the present time of writing this condition persists. Œdema disappears during the sleeping hours, but comes back promptly when the leg is used.

Remarks.—Excision of aneurisms can never be considered an ideal procedure. It is probably the most dangerous method of treatment. It is certainly the most difficult from a technical standpoint. It involves the removal of the vein in almost every instance, because the vein is so closely incorporated with the sac wall that they cannot be separated. They can hardly be dissected apart in the dead house.

In this case it would have been wiser not to have operated. The aneurism would probably have cured itself and undergone complete consolidation, and the femoral vein would have been kept intact. We should in this way have avoided the intense œdema which followed the operation. Even if the aneurism had not consolidated completely, but had continued to increase at its lower end, it would have been better to have obliterated the artery and the aneurismal sac and left the femoral vein untouched. An intrasaccular suture (old operation; Antyllus-Matas) would have cured the case with no greater risk of gangrene than excision and with a much better prospect of restoration of venous circulation.

Case III.—*Spontaneous aneurism of the left external iliac artery involving bifurcation of common trunk, ligature of common iliac unsuccessful; subsequent ligature of right internal iliac unsuccessful; distal ligature of left femoral followed by immediate hemorrhage; old operation* (Antyllus) *performed at once, followed by a cure.* C. F., colored man, aged twenty-seven, was admitted to the John Sealy Hospital in June, 1922, suffering from bilateral inguinal adenitis of gonorrhœal origin. He had a clear history of syphilitic infection, and the blood, Wassermann, was 2 plus positive. The suppurating glands were removed from both groins. A few days afterwards he complained of severe pain in the left groin and we found a pulsating swelling along the line of the external iliac artery. This proved to be an aneurism.

On September 2nd, through a transperitoneal incision through the left rectus muscle, the left common iliac was tied by my colleague, D. A. O. Singleton. Umbilical tape was used as the ligature. The left inferior epigastric artery was divided and tied during the operation. The aneurismal sac occupied the whole length of the external iliac artery and overlapped the bifurcation of the common trunk at its upper end. The patient was discharged at the end of a month apparently cured. Convalescence had been ideal. The circulation of the thigh and leg was good and no pulsation could be detected in the sac.

He was readmitted on March 19, 1923, with a return of pulsation in the aneurism. The sac was large and extended upwards from the inguinal ligament below almost as high as the umbilicus above. It filled the whole of the left iliac fossa and extended to the right as far as the middle line. Expansile pulsation was present. It was, however, less vigorous than before the operation. The bruit was well marked. The patient suffered from considerable pain referred mainly to the terminal branches of the femoral nerve in the thigh.

On March 28th the right internal iliac artery was tied with braided silk. The abdominal cavity was opened by a median incision and the aneurismal sac and left iliac arteries examined carefully. The sac had increased in size since the last operation. It now occupied the lower third of the common and all the external iliac trunks. (Fig. 3.) Proximal to the upper end of the sac the common iliac trunk seemed to be obliterated. No

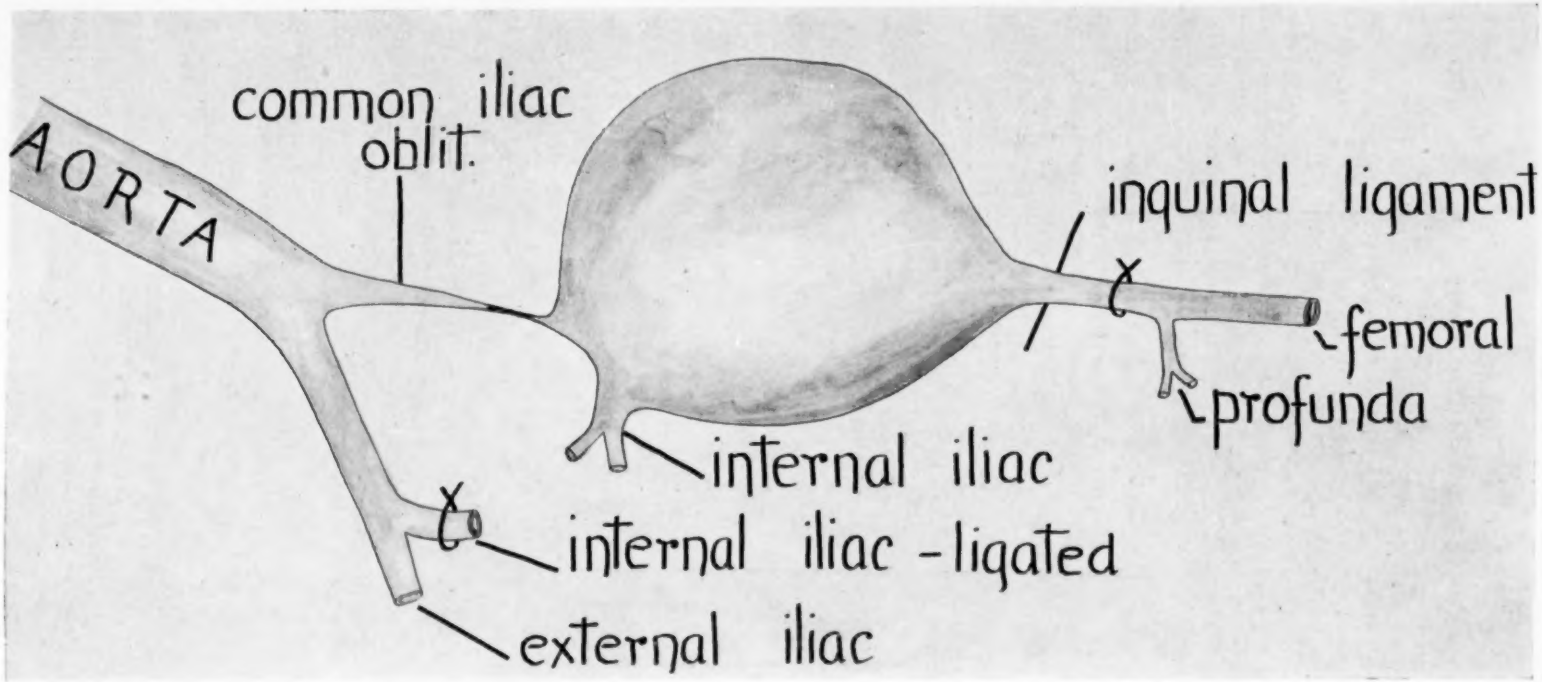

FIG. 3.—Sketch of the anatomical condition found in Case III at the time of the second operation. A ligature was placed on the *right* internal iliac. The ligature shown on the common femoral trunk was not placed there until the third operation. Note the complete obliteration of the left common iliac artery as the result of ligature at the first operation.

pulsation was present over the line of the artery and we could find no trace of the ligature that had been placed on it six months before. The left internal iliac artery could not be found. It appeared to be covered by the upper end of the sac. The ureter was dissected off the lateral wall of the pelvis and the side of the aneurismal sac, and an unsuccessful search was made for the internal iliac artery and its branches. As a last resort, in the hope of cutting off the anastomosis between the branches of the right and left internal iliac vessels, the right internal iliac artery was ligatured.

Pulsation was not very vigorous either before or during the operation. Compression of the right internal iliac appeared to stop it, and after the ligature was tied it was imperceptible. A few days after the operation, pulsation and bruit returned, showing that we had failed to find the collateral arterial branch which was bringing blood into the sac. We were uncertain as to its location. Thinking that it might come from below through the branches of the medial and lateral circumflex arteries *via* the profunda femoris and femoral, we applied digital pressure on the femoral trunk just below the inguinal ligament. The test was unsatisfactory, because on account of the scar tissue left by the operation on the suppurative bubo and the absence of pulsation in the femoral it was impossible to tell if pressure had been applied correctly. It seemed more probable that blood was flowing into the sac through some of the branches of the internal iliac of the same side or perhaps through an aberrant obturator artery. The inferior epigastric and deep circumflex arteries were taken into consideration, but we did not think it likely these vessels could be responsible for the persistence of the aneurism, because the lower end of the sac barely reached the level of the inguinal ligament. In addition, we had reason to believe that the inferior epigastric had been divided in the rectus abdominis sheath when the common iliac was tied. Believing that distal ligature of the femoral artery would stop the circulation through the sac, the operation was performed on April 16, 1923. It was necessary to expose the artery thoroughly in order to be sure of placing the ligature above the origin of the profunda femoris. To have shut off the profunda from the main femoral trunk would have been a blunder that would probably have been followed by gangrene of the leg, because it serves as one of the main collateral channels through which arterial blood reaches the thigh and leg after ligature of the common or external iliac or common femoral trunks. The profunda arose at an unusually high level just below the inguinal ligament. The inguinal ligament was divided and the femoral artery followed upwards until the lower end of the aneurismal sac appeared. A silk ligature was placed on the artery about an inch below the sac. (Figs. 3 and 4.) When it was tied it cut its way through the walls of the vessel as if they had been made of cheese. The proximal end of the artery began to bleed at once. It was seized with a pair of artery forceps, but the walls were so soft that the forceps would not hold. After several abortive attempts had been made to catch the bleeding end and tie it, the nose of the artery forceps slipped into the aneurismal sac and a furious gush of arterial blood occurred. The opening was plugged with gauze while we held an anxious consultation over the case. We came to the conclusion that the old operation (Antyllus-Matas) offered the only good chance of success. It was necessary, however, to get control of the proximal circulation. We had already tied the common iliac and had nothing left but the abdominal aorta. Accordingly, we opened the abdominal cavity and exposed the abdominal aorta and passed a ligature around it. The ligature was not tied, but served as a loop against which the artery was compressed by the finger of an assistant. To our amazement, compression of the abdominal aorta failed to stop pulsation in the sac. It was, however, impossible to abandon the patient, so we were under the necessity of opening the aneurismal sac without control of the proximal circulation and trust to our dexterity and luck to reach and control the bleeding vessel. The sac was opened in front by a long incision which divided the abdominal muscles which covered it. Furious arterial bleeding came from the upper and hinder part of the sac which was funnel-shaped. The bleeding stopped when the funnel was blocked with the tip of the forefinger, or when it was packed tightly with gauze. After trying in vain to get a view of the interior of

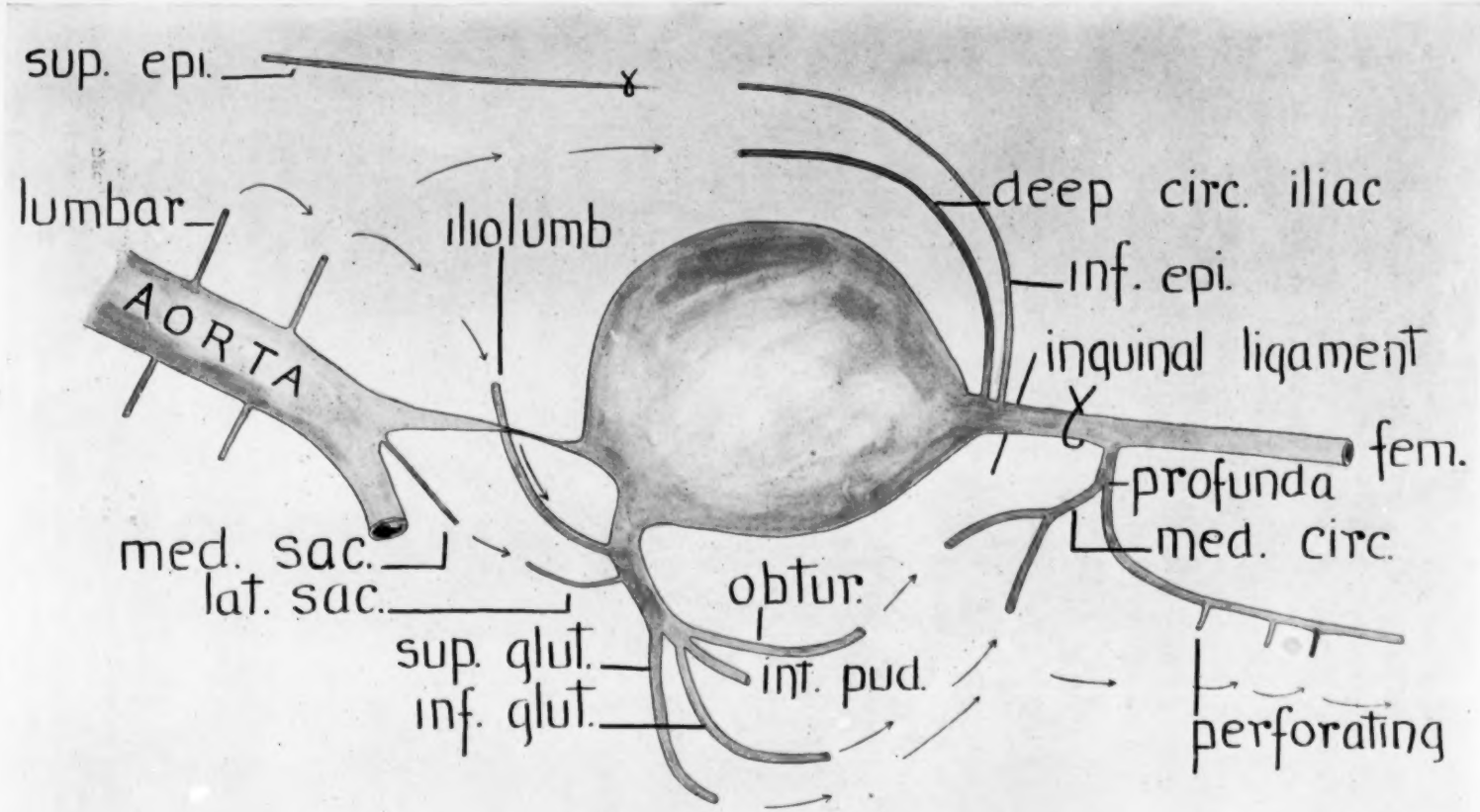

FIG. 4.—Anatomical condition present in Case III at the time of the third operation when a ligature was placed on the common femoral trunk at its origin. The collateral circulation has been inserted very carefully. It shows that practically all the blood comes from the same side (left) through the lumbar aortic branches and middle sacral artery proximally into the iliolumbar and lateral sacral distally, thence by the superior and inferior glutæls into the glutæl region to join the crucial anastomosis with the branches of both femoral circumflex arteries. The anastomosis of the obturator with the medial femoral circumflex is also shown. It is sometimes very important. In this case the inferior epigastric and the deep circumflex iliac did not enter into the anastomosis, beeause they were shut off by the ligature placed on the femoral.

the sac for the purpose of stitching up or clamping the bleeding aperture, we succeeded with some difficulty in carrying a strong ligature around the neck of the funnel by means of a curved needle which was passed from the interior of the sac, guided by the left forefinger, which served as a temporary plug. The ligature was tightened as the forefinger was withdrawn, and knotted tightly. Our anxiety was intense. Happily, bleeding ceased at once. The rest of the sac wall was inspected, but no other arterial openings were found. The cavity of the sac was then packed lightly with iodoform gauze, the ligature withdrawn from around the abdominal aorta and the abdomen closed.

The patient made an uninterrupted recovery. The circulation in the leg was never embarrassed at any period. He left hospital May 27th, with a perfect leg. During convalescence he complained of pain in his left upper chest. X-ray examination showed a small aneurism arising from the left side of the transverse portion of the thoracic aorta.

The most puzzling feature of the case was the failure to control circulation through the aneurismal sac by compression of the abdominal aorta. It can only be explained by the opening up of the anastomotic channels between the lumbar branches of the abdominal aorta and the parietal branches of the internal iliac, as a result of the ligature of the common iliac seven months before.

A study of the attached diagrams and legends will explain both the normal and pathological anatomy of the condition.

In Fig. 5 we see a view of the left side of the pelvis which shows the normal anatomy of the common iliac artery and its branches. The branches of the internal iliac stand out very clearly. Proximally we see the iliolumbar artery passing upwards under cover of the psoas magnus to anastomose with the lumbar branches of the abdominal aorta and with the deep circumflex iliac. Then in order we see the lateral sacral, the superior gluteal, the obturator, the inferior gluteal (O T sciatic), the internal pudendal, and middle hemorrhoid arteries. From the distal end of the external iliac two trunks arise, *viz.*, the inferior epigastric and the deep circumflex iliac.

In Fig. 6 the anastomoses between the iliolumbar, deep circumflex iliac and the lumbar branches of the abdominal aorta are shown. Also those between the medial and lateral sacral arteries.

In Fig. 7 the anastomoses between the superior gluteal, inferior gluteal, medial circumflex and the perforating branches of the profunda are shown.

In Fig. 8 the profunda femoris and its medial and lateral circumflex branches are shown to indicate the great importance of this artery in carrying on the circulation either directly or by means of its anastomosis. The arteria genu suprema, a direct branch from the femoral, is shown clearly.

In the following description frequent reference to these diagrams will be needed in order to understand the text.

After ligature of the common iliac artery blood passes into the lower extremity of the same side through the following channels (Figs. 5 and 6); from the lumbar branches of the abdominal aorta into the lumbar branches of the iliolumbar artery, from the lumbar arteries into the circumflex iliac, from the middle sacral into the lateral sacral, and from the superior into the inferior epigastric artery. If we trace the stream passing in a retrograde direction

upstream through the iliolumbar and lateral sacral arteries, we can see that it flows into the main trunk of the internal iliac artery and then divides into two currents. One passes proximally around the bifurcation into the external

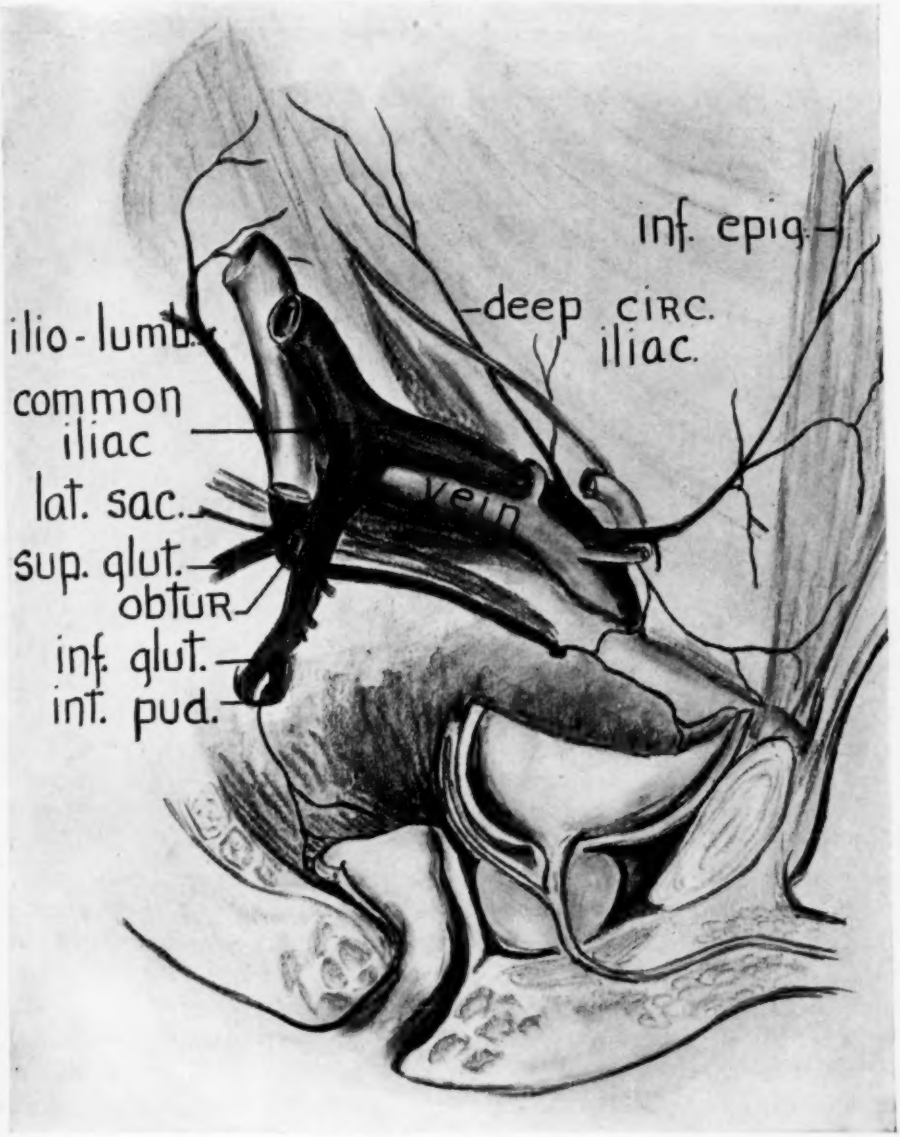

FIG. 5.—Modified from Spaltehoitz shows the anatomical relations of the left common iliac artery and its branches. The internal iliac trunk and its branches are brought into relief. The middle hemorrhoidal artery arises from the internal pudendal.

iliac (or aneurismal sac) whereas, the other flows distally into the other branches of the internal iliac. If the common iliac trunk had been ligatured for an aneurism of the external iliac, the stream of blood through the aneurism would be arrested if consolidation occurred. If, however, consolidation failed,

some blood would still circulate through the aneurismal sac, and, as time passed, the quantity would increase until pulsation was almost as vigorous as before. Consolidation of the aneurism would throw all the blood into the other branches of the internal iliac and the increased flow down the gluteal arteries would open up the anastomoses between their terminals and the branches of the medial and lateral femoral circumflex and the perforating arteries below (Fig. 7) (crucial anastomosis). By this means, blood would reach the profunda femoris. This stream would divide also. Part of it would flow peripherally down-stream through its terminal branches to reach the anastomoses with upper geniculate arteries and arteria genu suprema by means of which it would reach the lower portion of the femoral and the upper portion of the popliteal trunks (Figs. 7 and 8). The other part would flow centrally up-stream along the profunda until it reached its main trunk, thence into the femoral artery and so down the thigh into the leg.

The current of blood into the terminals of the deep circumflex iliac would come from two sources (Fig. 6): from the lumbar branches of the abdominal aorta and from the iliolumbar artery. The current would flow centrally (up-stream) along this vessel and open into the external iliac just above the inguinal ligament. The current passing along the inferior epigastric (Fig. 5) would be derived from the superior epigastric where the two arteries mingle with one another in the upper portion of the rectus sheath. It would also flow up-stream to join the current in the external iliac just above the inguinal ligament. Blood from these two latter sources would be of the greatest value in nourishing the thigh and leg. The importance of these arteries as carriers of blood into the external iliac below the aneurism is so evident that unusual care should be taken to save them from injury whenever the common iliac artery is tied. Consequently the rectus abdominis incision should never be used in intraperitoneal ligature of the iliac arteries. On the other hand, in cases of iliofemoral aneurism in which ligature of the common or external iliac has failed to stop the pulsation in the sac, it may be necessary to tie both of these trunks deliberately for the purpose of arresting recurrent pulsation.

Failure to cure an aneurism of the external iliac by ligature of the common iliac is caused by too much blood reaching the sac through the internal iliac artery of the same side. Wide open anastomoses decrease the risks of gangrene of the leg, but increase those of recurrent pulsation.

The risks of gangrene do not seem to be great, particularly if the aneurism is confined to the external iliac. If, however, the aneurism has encroached on the internal iliac and its branches or on the femoral where it gives off the profunda femoris, the risks are increased seriously. It has been pointed out by Halsted that ligature of the common iliac is less likely to be followed by gangrene of the limb than ligature of the external iliac. Although case records support this statement, it is impossible to accept it unreservedly without subjecting it to critical scrutiny. It is then revealed that the danger of gangrene is influenced more by the position of the aneurism than by the site of ligature and that spontaneous or operative cure of an aneurism is attended by its own

peculiar dangers because it is followed by the blocking up of the only possible channels by which blood can reach the periphery. We have long known that complete consolidation of the sacs of many aneurisms of the abdominal aorta results in blocking up of the arteries arising from the sac and death of the organs supplied by these vessels. Thus, consolidation of an aneurism of the

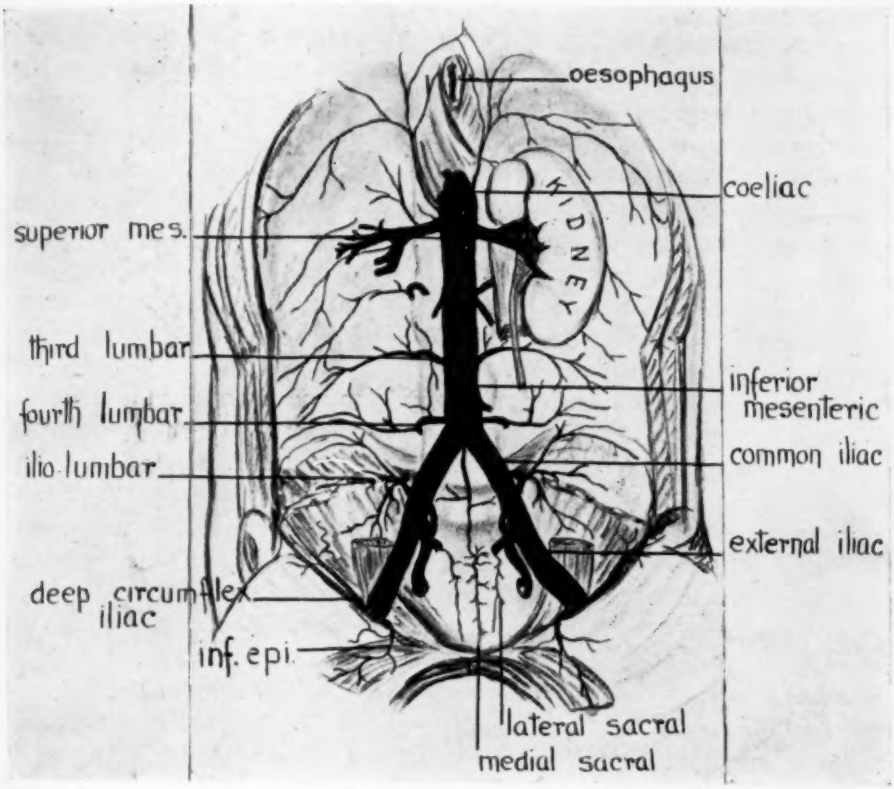

FIG. 6.—Modified from Spalteholtz shows very clearly the anastomosis between the fourth lumbar artery and the ilio-lumbar, and between the medial and lateral sacral arteries.

upper abdominal aorta will block up the renals or the superior mesenteric and produce necrosis of the kidneys and the intestines. Likewise, in considering the iliacs and their branches, we find in treating aneurisms of the gluteal arteries which occupy the direct posterior anastomotic channels carrying blood to the thigh, that ligature of the common iliac is quite a dangerous procedure, but that direct attack on the aneurism followed by ligature of the common iliac is more dangerous still; also that in ilio-femoral aneurisms, ligature of the external iliac is almost without danger of gangrene if the aneurism stops short of the origin of the profunda femoris; but that if the aneurismal sac includes the origin of the profunda femoris gangrene occurs more frequently, because consolidation of the sac excludes the circumflex arteries and the profunda trunk from the collateral circulation.

Recurrent pulsation, on the other hand, may often be "an angel in dis-

guise." As a rule it is a sure sign that the collateral circulation is efficient, in part at least, and it indicates that blood is reaching the sac in considerable quantity. It is often difficult to say which one of the collateral branches is carrying blood into the sac, especially in some situations as in the lower portion of the neck and axilla; or whether more than one branch is engaged in the task, as happens very frequently in these regions. In such arteries as the iliacs and femoral the collateral channels form such a definite row of anastomoses from above downwards that there is less uncertainty, and one can apply the laws of probability with less chance of error. When recurrent pulsation appears in an iliac aneurism after the common iliac artery has been tied, almost all the blood reaching the sac is derived from the internal iliac of the same side. A small quantity may be derived from the opposite internal iliac through the anastomoses between the communicating uterine, internal pudendal and middle hemorrhoidal arteries, but it is probably negligible. Blood flowing through the inferior epigastric, the accessary obturator and the deep circumflex iliac would exert an influence only on aneurisms of the lower part of the external iliac and the upper part of the femoral. The internal iliac is so large an artery and has so many large and important branches that it is rather surprising, on reflection, that any aneurism of the external iliac undergoes consolidation after ligature of the common trunk alone. The volume of arterial blood coursing centrally (up-stream) along the iliolumbar and lateral sacral branches into the main trunk must be considerable, and if the gluteal arteries are not wide open enough to transmit it readily to the posterior aspect of the thigh, a large part of it would naturally be diverted in the direction of lower resistance, *i.e.*, up the internal iliac and around the corner down into the external iliac and through the aneurismal sac.

It would appear from the facts presented that the internal iliac artery* occupies a unique and strategic position in the circulatory system of the lower extremity, for under certain conditions blood may flow along it in either direction. If the external iliac alone is blocked, blood flows along the internal iliac distally into the inferior gluteal, and so into the crucial anastomosis. If the common iliac alone is blocked, blood flows through the internal iliac proximally into the external iliac and so down the femoral. It is a most convenient cut-off through which the stream of blood can flow now upwards and now downwards, as necessity requires. Still it is not indispensable. It can be tied without any serious disturbance to the circulation in the parts of the body to which it is distributed, and without danger to the life of the lower limb. But if during the process of tying the main trunk, its branches are also blocked, the direct flow of blood from the iliolumbar and lateral sacral above into the gluteal below will be arrested and the direct chain of anastomoses into lower

* In early embryonic life it is a most important artery because the primitive inferior glutæl arises from it and forms the earliest known artery of the lower limb. This is later on converted into the inferior glutæl and popliteal arteries of the adult. The external iliac and femoral are later developments, and as they increase in importance the primitive glutæl dwindles considerably.

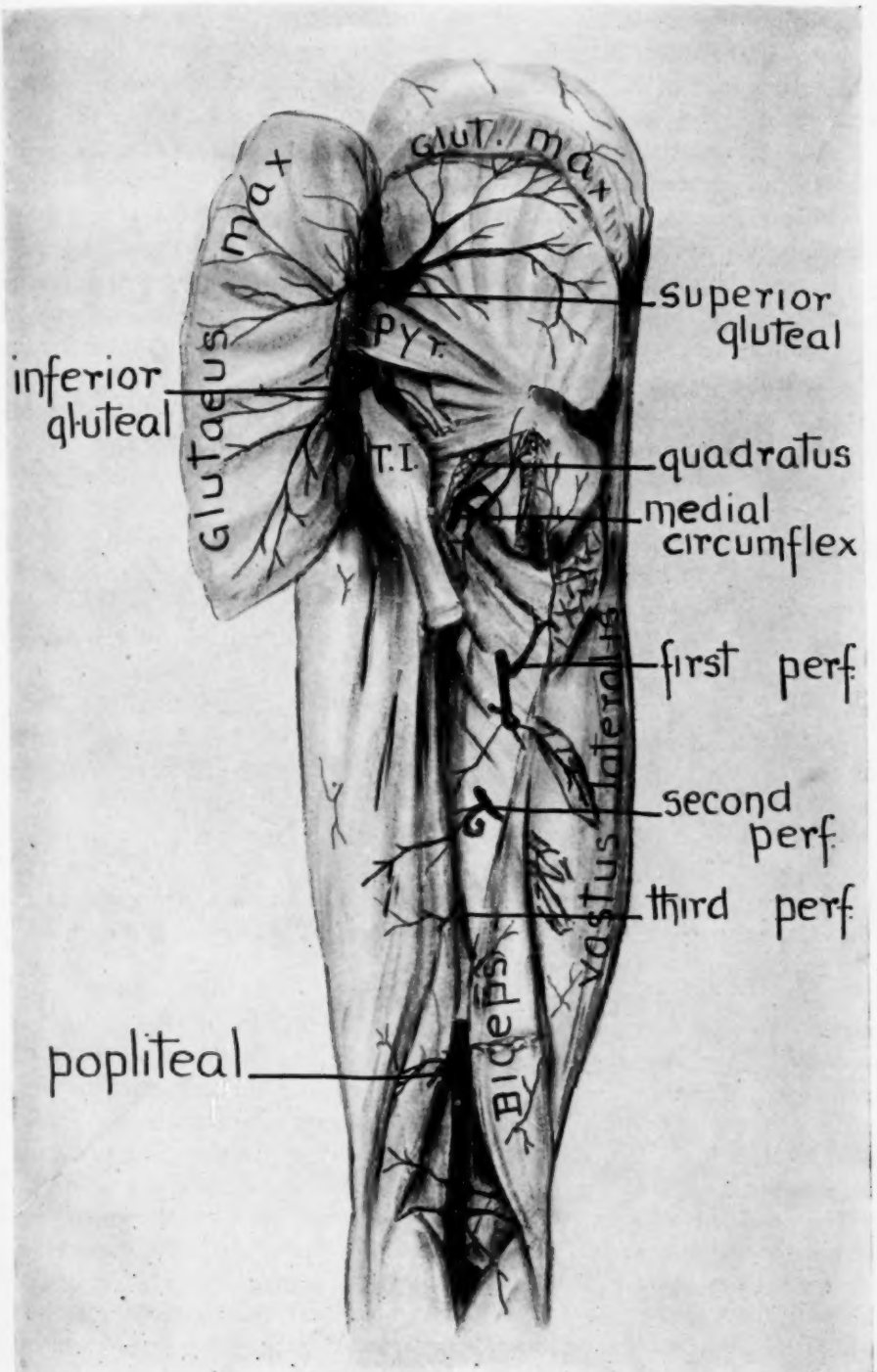

FIG. 7.—From Cunningham, shows the anastomotic chain between the superior and inferior glutæl and the branches of the medial and lateral circumflex (crucial anastomosis) and the perforating branches of the profunda femoris.

limb will be broken. This will probably not be attended by any serious consequences if the direct flow from the common into the external iliac is still unobstructed. But if that channel is also blocked, gangrene can hardly be averted.

It seems reasonable to infer from the facts at our disposal that the surest way to cure an aneurism arising from the external iliac and encroaching on the bifurcation of the common is to tie both common and internal iliac arteries simultaneously. Direct flow through the aneurism would stop at once and could never be reëstablished if the ligatures held fast. Therefore recurrent pulsation would be impossible. The danger of gangrene would perhaps be slightly increased, because the whole strain of the circulation would be thrown on the collateral channels by the immediate and complete blocking of the path through the sac. We have previously pointed out that defective collateral vessels will often dam the blood back into its original channel through the sac and produce recurrent pulsation. It is clear that if the cut-off or safety valve is obstructed that gangrene is sure to follow if the collateral circulation is defective.

The technical difficulties of ligature of the internal iliac artery are not great, if the artery is exposed by the intraperitoneal route. The artery is 37 mm. (1½ inches) long. The ureter crosses it at its origin and runs distally along its anterior border. The internal iliac vein lies posterior to the artery. On its lateral side it is separated from the psoas muscle by the external iliac vein, and at a lower level from the side of the pelvis by a mass of fat through which the obturator nerve passes forwards. The pelvic colon lies in front of the medial side of the left artery. The easiest way to find the artery is to expose the bifurcation of the common iliac trunk and to follow the internal iliac downwards. The ureter will peel upwards with the peritoneum. Care should be taken to keep inside the arterial sheath and to avoid injuring the veins. The proximal portion of the artery should be tied so as to avoid any possibility of injurying any of its branches.

In Figs. 3 and 4 we have presented a schematic picture of the aneurism described as accurately as we were able to visualize it at the time of the last operation. Figure 3 shows the aneurismal sac as it was when the distal ligature was placed around the femoral artery above the origin of the profunda. Figure 4 shows the same conditions with the anastomotic trunks through which blood flowed into the sac and down the thigh. The foregoing text will be greatly simplified by constant reference to these figures.

The rapid and complete cure following the operation was very gratifying, but not surprising, because it is now well known that once the dangers of primary hemorrhage are avoided, that the intrasaccular suture of aneurism (Matas) is less likely to be followed by complications than any other method of treatment. Recurrent pulsation cannot occur, gangrene is less frequent, impending gangrene is frequently averted, and œdema is usually relieved. There are two main reasons for the satisfactory results of the operation.

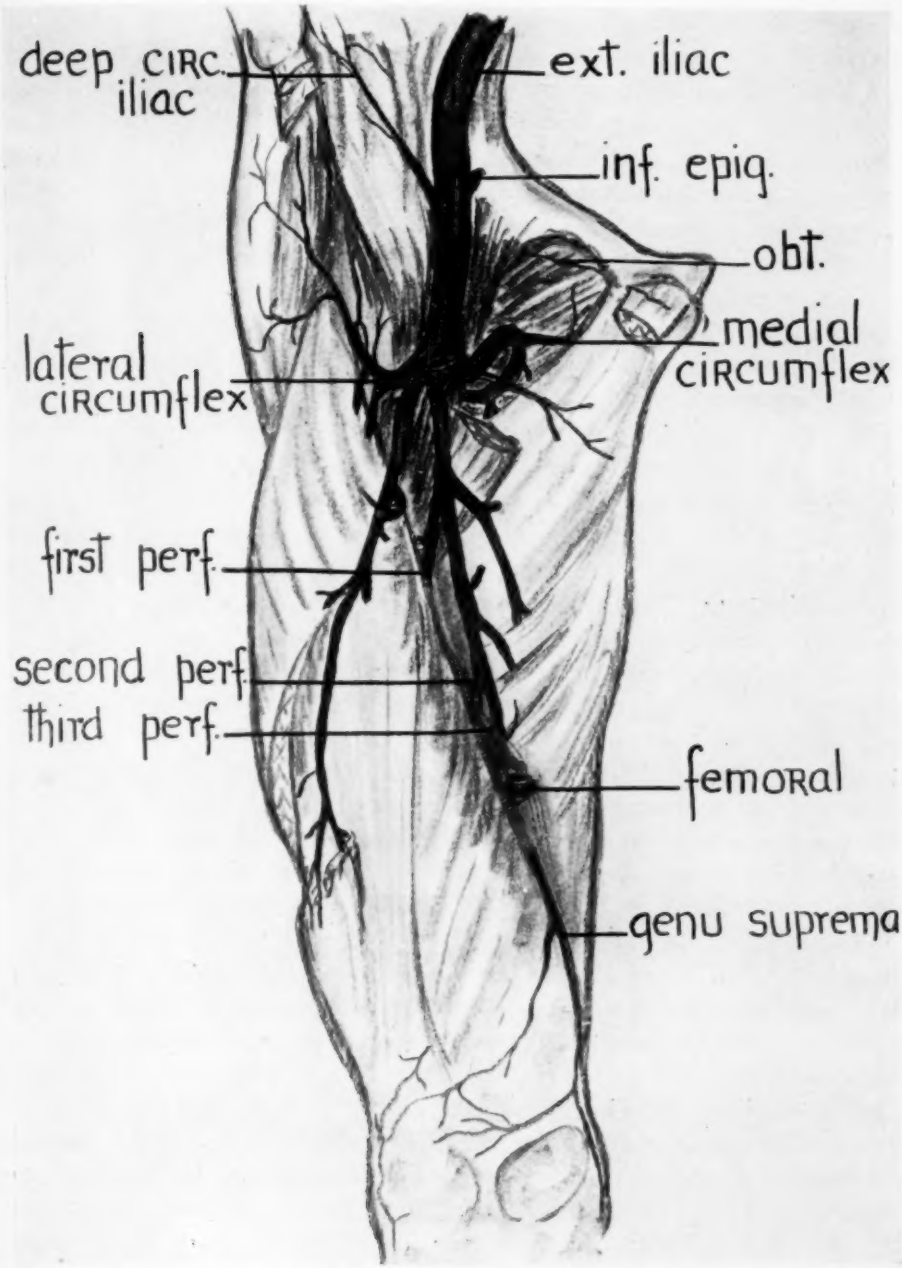

FIG. 8.—From Cunningham, shows the proximal portion of the femoral artery and the termination of external iliac. The distal portion of the femoral has been removed. The profunda femoris and its branches are shown. Part only of the medial circumflex is seen. The whole course of the lateral circumflex is exposed.

Firstly, evacuation of the clots from the sac relieves the surrounding tissues from pressure. This allows the collateral arteries to open up to their full capacity and often relieves impending gangrene. It also allows the companion

veins to expand and œdema is similarly relieved. Both these results are seen with surprising rapidity after evacuation of the clots from a popliteal aneurism. *Secondly,* the suture of the arteries opening into the sac is done from within, consequently the walls of the sac are not disturbed, and collateral channels cannot possibly be injured. Further, and I believe this is the most important reason of all, any vital trunk, such as the profunda femoris or internal iliac, is closed by suture at its mouth, and the arterial stem and its branches are not endangered. This constitutes the main difference between the Matas operation and the operation of Antyllus. In the original Antyllus operation, the arteries entering the sac were secured by careful dissection before the sac was opened. This of course endangered the collateral circulation.

The essential safeguard of the Antyllian operation is hemostatic control. Where this is impossible, the procedure is unsurgical and is rarely justifiable. It is true that Syme, with unusual courage, broke the rule. He boldly opened aneurisms of the gluteal, axillary and carotid, trusting to his sense of touch to block up the bleeding artery with his forefinger while he secured the vessel with a ligature. But Syme was a genius, and, we may say, very fortunate to avoid disaster. Other surgeons, after incising the sac, have used the pack as a last resort when bleeding could not be arrested. Lately Edward B. Anderson, of Chattanooga, reported two cases, one of iliac and one subclavian aneurism, in which he succeeded in stopping bleeding by the pack. Still in spite of these successes, it would be very unwise to resort to such hazardous procedures. Rather, do we contend, that the Antyllian rule, making control of the circulation imperative, is just as binding now as when it was written. Absolute control of the circulation through the iliac arteries ought to be possible if the abdominal aorta is compressed at a high level. If pressure is applied above the origin of the lumbar arteries, which would then be cut out of the anastomotic field, no blood could possibly reach the interior of the sac through the iliac arteries. The sac could be inspected without hindrance and the openings of the vessels sutured. It is, however, very unlikely that modern surgical opinion will indorse a suggestion to treat iliac aneurisms by the open method as a primary procedure. A large proportion of the iliofemoral aneurisms and a fair but smaller number of aneurisms occupying the common iliac and its branches are cured by proximal ligature of the external or common iliac, operations which are comparatively easy to perform and not dangerous to life. Therefore it is only fair to give safer methods a trial and only to resort to the more difficult and hazardous procedure in the event of failure.

While reviewing the literature bearing on the operative treatment of aneurisms of the iliac artery, I received a long personal letter from Dr. Rudolph Matas in which he most generously placed at my disposal the list of cases that have been treated by the intrasaccular method of suture which we owe to his genius. So far, I have been unable to find either from

my own search or from the list collected by Matas a single case where an aneurism of the common iliac artery has been opened deliberately with the intent to close either by ligature (Syme-Antyllus), or by suture (Matas), the arterial trunks opening into it. The difficulties met with in controlling the arterial circulation and the terrifying possibilities of being unable to obliterate the opening into the sac are formidable enough to deter any surgeon who is not possessed of unusual courage and skill from attempting such a hazardous operation. In our case we were fighting for the patient's life with our backs to the wall. We had no other alternative except packing the sac with gauze, which I have always looked upon as a very unsatisfactory method of arresting arterial hemorrhage. Our consternation when we found that compression of the abdominal aorta did not control the bleeding, was complete. As long as I live I shall never forget the anxious minutes that followed until the internal iliac trunk was safely secured, and the bleeding was controlled. In Halsted's monograph on "Ligature of the Common Iliac Artery," he reports two cases which resemble in some respects my own case and which demonstrates emphatically the unusual dangers of opening the sacs of aneurisms of the iliac arteries. The following abstracts bring out the essential facts.

CASE XVIII.—(Group ii) KORTE. *Ligation of the right common iliac artery for ruptured aneurism of the internal iliac. Consecutive ligature of the abdominal aorta. Death.* The case was one of a ruptured aneurism of the right external iliac artery in which the hæmatoma extended upwards retroperitoneally as high as the lower margin of the thorax and filled completely the flank and loins. The right common iliac was ligatured by the intraperitoneal route. Pulsation and bruit ceased in the aneurism, but the large hæmatoma in the right side did not become smaller and continued to cause distress. Thirty-seven days after the first operation, a second one was undertaken. An incision was made into the hæmatoma. Large clots of blood were forced out under great pressure and profuse arterial bleeding followed. The cavity was packed and by the transperitoneal route the aorta was ligated over a pad of gauze. Bleeding ceased and the sac was opened wide and its contents evacuated. Slight bleeding was found coming from an opening in the interior of the sac (probably the mouth of the internal iliac artery) at the right edge of the true pelvis, which was controlled by pressure. The abdominal aorta was then tied permanently and the wounds sutured. The patient died an hour after the operation. At the autopsy other aneurisms were found in the thoracic aorta, right femoral and right profunda femoris arteries.

CASE XXIII.—(Group I) TRENDELENBURG, FRIEDRICH. *Ligation of the left common iliac artery for aneurisma dissecans of this vessel. Death.* An exploratory laparotomy was made for an obscure abdominal tumor in the region of the descending colon. A large retroperitoneal hæmatoma was found. This was opened and the coagula were removed. Suddenly profuse arterial bleeding occurred from a large pulsating aneurism situated in the region of the left common iliac artery. Under compression the rent in the aneurism became larger. It was then opened and a tremendous hemorrhage occurred. A ligature was applied to its root near the aorta. Hemorrhage from the distal side was controlled by a clamp and by tying off the rent with a strip of gauze. The patient died in three hours.

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COMBINED EXTIRPATION AND OBLITERATION IN THE TREATMENT OF VARICOSE VEINS*

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The problem of varicose veins has always been a very important one to the medical officers of the Army, since the soldier must, from the very nature of his occupation, carry a heavy pack upon his shoulders and be on his feet constantly during drills or long marches, with the result that he is therefore very prone to develop such a condition. While the manifestations of this condition can be treated by palliative measures with a fair degree of success in the civilian population, so that their daily routine can be carried on with little or no inconvenience to themselves, it is not so with the soldier who is frequently called upon to make long marches and undergo physical hardships which of necessity demand that he be sound in body and mind.

Early in his military career, the author was confronted with this very perplexing problem, and after using all the classical operations then in vogue for the radical cure of this condition with indifferent success in the soldier, he looked for a better method.

After a long series of experiments on the cadaver, he conceived the idea of removing the offending veins by tying them at the saphenous opening as in the Trendelenberg operation and then lower down in the course of the same vein making a transverse incision and introducing a silver wire loop up through this opening and along the dilated lumen, tying the upper end of the vein to this loop, and by gentle traction downwards, removing the vein by inverting the vessel upon itself and repeating this process wherever the tortuosity of the vessels does not prevent the manipulation, as shown in Fig. 3, Plate B.

This operation was first tried out in 1901, and the results of it published in the *New York Medical Journal* and the *Philadelphia Medical Journal* for August 19, 1905, but was later superseded in the opinion of many operators by the well-known Mayo stripper operation, published in the *Surgery, Gynæcology and Obstetrics* for April, 1906.

The operation then advocated by the writer proved eminently satisfactory on those veins, having a relatively straight course, such as the internal saphenous, but the tortuousness of the anastomosing veins about the popliteal space and in the calf of the leg frequently presented difficulties which permitted only short sections of the vein to be removed at a time and thus nullified in a measure the value of the operation except for the non-tortuous type of vein.

The presence of linear scars on the soldier's body, especially if they follow

* Published with permission of the Surgeon General, U. S. Army, who is not responsible for any opinion expressed or conclusions reached herein. J. F. Siler, Secretary.

operation in the service, is objectionable for many reasons. First, to the conscientious man they may occasionally prove a source of irritation from wearing the legging or be painful by the incorporation of some of the cutaneous nerves within the scar tissue, or secondary, by interference with the full freedom of locomotion as the result of adhesions between the cutaneous tissues and the underlying muscle planes. Third, the reprehensible art of malingering has numerous followers in the Army as well as outside, and the malingerer constantly points to these scars and presents a series of lame apologies for his inability to do full military duty, hoping eventually to secure his discharge through disability, as he did successfully in the days when the old linear incisions were used to expose the veins for excision. During the late war the linear incision method was resurrected and used by some surgeons on unsuitable cases as those showing marked pigmentation and beginning ulceration common at the point of greatest blood stagnation, with the result that there are many men with painful scars that break down from the slightest trauma drawing compensation from the Government and who will continue to do so for the rest of their days (Plate III, Fig. 1).

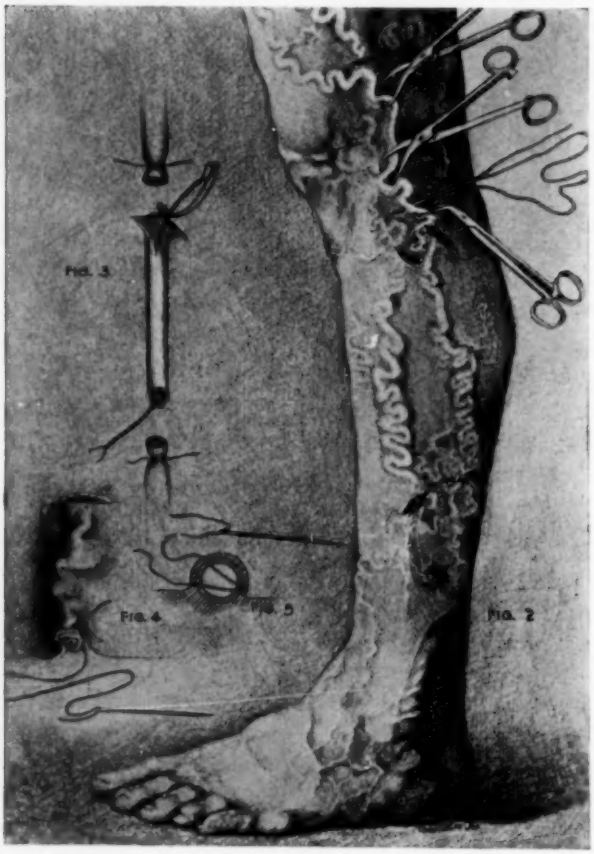

PLATE I.— Showing the different steps in the operation.

Confronted thus with these difficulties, the author, with precaution necessary to insure safety, set about to devise some method of procedure which would give a more hopeful aspect to the situation and effect a cure, without leaving the patient with a series of these linear scars, which, at least, are unsightly, if not incapacitating.

It is the opinion of the writer that the removal of the tortuous vein plays but a small part in the cure of the disability incident to the general varicosity. It is believed that the essential feature is the complete obliteration of the lumen of the vein and all its connections with the deep circulation. If this is suc-

cessfully accomplished, it is questionable whether or not it is necessary to remove the varicose vessel itself. As a preparatory measure the night preceding operation, the limb is shaved and the varicose veins are made more prominent by a circular bandage below the saphenous opening, and they are outlined with a five per cent. alcoholic solution of brilliant green while the patient is in a standing position.

The technic of the first step of the operation consists in the removal of the internal saphenous and other non-tortuous veins by the inversion method which was described in 1905, as shown in Plate I, Fig. 3.

In the second step of the operation, a continuous suture of strong braided silk, number one or two, is used, and the essential feature of the operation is in the manner of its application with a heavy straight triangular cutting needle. The veins to be obliterated are blocked out between the proximal and distal incisions as shown in Fig. 2, Plate I, six to ten inches apart and divided between ligatures. The vein is made more accessible for suture by elevation with towel clamps which encircle it as shown in Plate I, Fig. 2. The needle is first passed under the vein and out on the opposite side, reintroduced at the point of exit and passed in front of the vein subcutaneously to the starting point, where it again emerges and thus encircles the vein and is tied as shown in Plate I, Fig. 6. From this point the suture is continuous and is first passed through the posterior third of the vein, the needle is reintroduced at the point of exit and passed through the anterior third of the vein and thus continued for four or five inches, when the needle is again passed completely around the vein, as done in the first step and the free end of the suture is pulled through the needle far enough to permit the suture to encircle

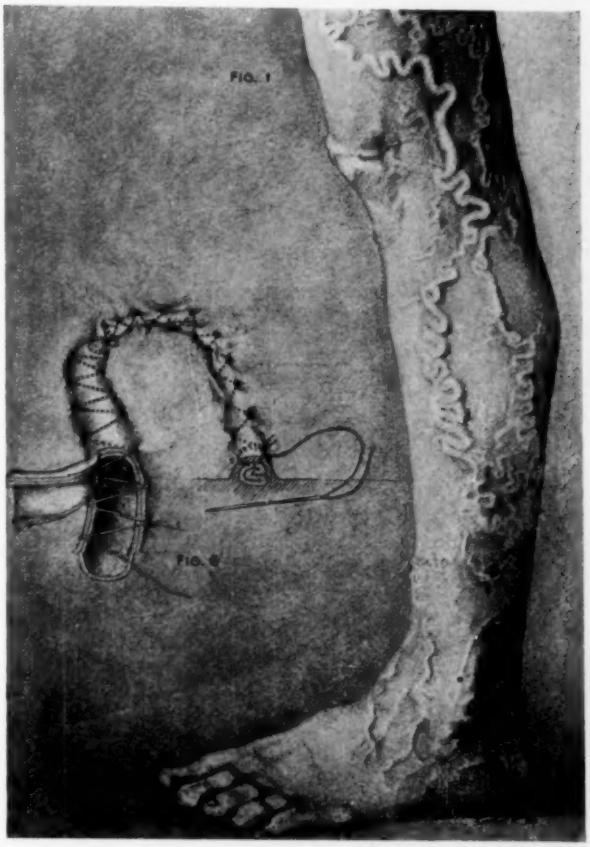

PLATE II.— Figure 1 showing tortuous veins suitable for this method. Figure 6 showing subcutaneous application of suture.

the vein doubled and the long end of the suture encircling the vein is tied and cut, which permits the original suture to be continued to the end of the section where it is tied after encircling the vein. The small incisions used are closed by accurate interrupted sutures. Care is taken to include in this continuous suture all small lateral branches entering the main vessel. Such an application effects not only a complete collapse of the vessel walls, but the injury done to the intima of the vessel by the puncturing needle and the resulting pressure from the ligature has sufficient thrombo-genetic action to insure almost entire obliteration of the dilated lumen as shown in Plate III. All sutures removed on tenth day.

PLATE III.—1. Healed ulcer in upper end of linear scar that persisted for two years. 2. Usual appearance of limb after removal of subcutaneous sutures. 3. Tortuosity shown here and in Fig. 1, especially suitable for this method.

The following is the pathologist's report. One mass of the young connective tissue replacing the lumen shows its cells widely separated and its lymph-spaces dilated, probably due to mechanical œdema. One cross-section of a medium-sized vein shows approximately one-tenth of the lumen remaining partly lined by thickened epithelium. There is a connective-tissue trabecula separating this portion of the lumen from the remainder which has been filled with young connective tissue. One area of this connective tissue is markedly œdematous. A section of a larger vessel shows complete obliteration of the lumen, atrophy and round-cell infiltration of involuntary muscle. The organization of this large vein has been accomplished by the formation of numerous formed blood-vessels. (Section removed six weeks after operation for pathological examination.)

Of course a nicety of the operation consists in the amount of tension to be applied to the suture so as not to produce œdema of the skin over the course of the suture and as a further precaution against this condition, the skin at intervals along the course of the suture is slightly scarified.

Proper marking of the vein to outline its tortuosity is imperative as it is

absolutely essential that the vein is properly elevated with the towel clamp to insure transfixion with the needle if success is to be assured. If no dye is available, the proper application of the towel clamp may be facilitated by the temporary use of a tourniquet to make the vessels prominent.

In some instances there persisted along the course of the occluded veins a suggestion of a ridge as shown in accompanying photograph of one of the completed cases, but on exploration this proved to be the collapsed vein plus considerable fibrous tissue.

PLATE IV.—Longitudinal section of a medium size vein showing the partially obliterated lumen to be markedly irregular in linear aspect.

This method is not conducive to rapid operating as it consumes more time than either the open or the subcutaneous method of extirpation, but the final result is more satisfactory.

The advantages of the method just described are:

1. Its simplicity.

2. The obliteration of the vessel lumen.

3. The absence of scarring following operation.

4. The ligation of both proximal and distal ends preclude the possibility of recurrence *per se* provided all collateral branches are included in the sutures.

5. The absence of painful subcutaneous areas that frequently follow the application of the time-honored independent or interrupted subcutaneous sutures which permits of an accumulation of blood between each adjoining suture. This accumulation may occasionally become infected, and if so, lead to other complications.

6. It is applicable where other methods are not, and it is immaterial if limited pathological changes exist within the vessels themselves rendering them friable or brittle, or if marked tortuousness precludes the successful use of other methods.

In view of these facts, it is believed that there is presented here a method which offers a promising beginning along simple lines in the treatment of varicose veins, and the results have proven universally satisfactory.

The illustrations accompanying this article are self-explanatory.

Of the thirty-three cases operated by this method, 15.1 per cent. have been operated over two years; 39.4 per cent. have been operated over one year; and 45.5 per cent. have been done less than a year, and the results have been satisfactory in all cases.

VALUE OF PRELIMINARY CIRCULAR CONSTRICTION BY RUBBER TUBE IN CERTAIN CASES REQUIRING AMPUTATION*

By Robert Emmett Farr, M.D.

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An emergency in which amputation of the arm seemed absolutely necessary and in which the condition of the patient was such that, in the writer's judgment, a fatal issue would inevitably follow amputation, was the occasion for utilizing a rubber elastic tube. Its use was so simple and it answered

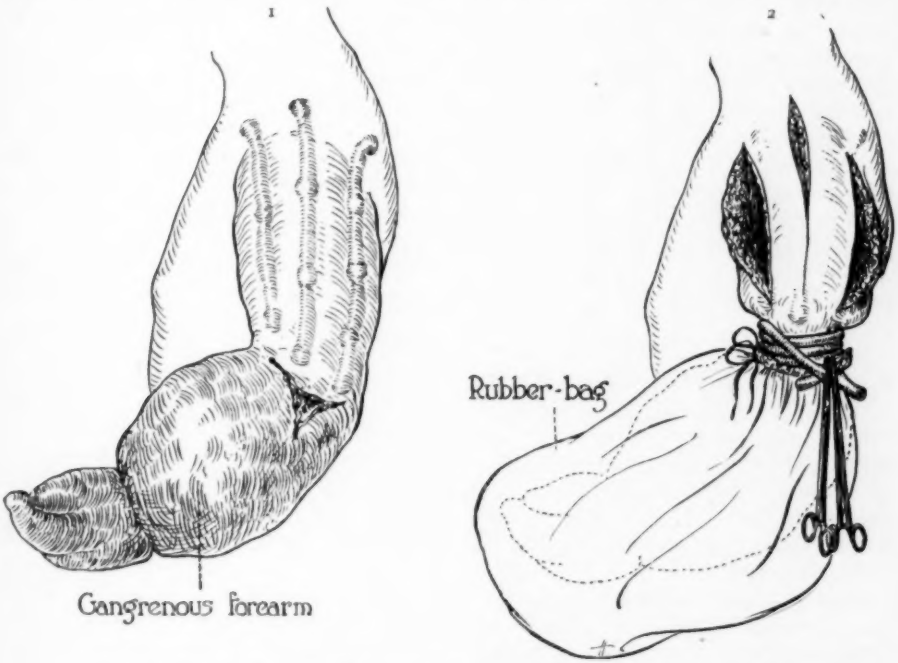

Fig. 1.—Case I. Gas distended arm. Lines of infiltration with novocain solution.
Fig. 2.—Case I. Showing multiple incisions of the arm and exclusion by means of tourniquet of gangrenous forearm.

the purpose so admirably—in fact as no other method, in our opinion, would have done—that we think it worth while to suggest its use in similar cases as well as in a variety of other conditions.

Case I.—Robert N., age sixteen, had the misfortune of having his left arm run over by a truck on March 19, 1923. Two days later he was seen by Dr. E. S. Geist, who kindly referred him to me for treatment. When examined, the boy, who had had an extensive hemorrhage at the time of the accident, was in a precarious general condition. His hæmoglobin was 28 per cent., Dare method, his temperature was 102, his pulse 120,

* Presented before the Minnesota Academy of Medicine, February 13, 1924.

and the wound showed gas-forming bacilli. Any extensive operative procedure seemed entirely unjustified. He was given large amounts of normal saline, but transfusion was withheld on account of fear of anaphylaxis. Locally, the boy's arm was gangrenous to a point just above the elbow and the forearm was greatly distended with gas. From the elbow to a point extending well above the shoulder the skin was reddened, alive, and the tissues were greatly swollen and distended with gas. (Fig. 1.)

Treatment.—Under local infiltration anæsthesia, multiple incisions were made longitudinally along the arm extending above the shoulder and upon the chest and back. (Fig. 2.) The subcutaneous tissue, although distended with gas, presented no necrosis above the elbow. Amputation just above the elbow seemed absolutely necessary, but the precarious condition of the boy seemed to contra-indicate this, while it was necessary to eliminate this greatly enlarged gangrenous member from the patient's economy. Accordingly a new piece of rubber tubing one-half inch in diameter was wrapped tightly around the arm at the line of demarcation and securely anchored in place. (Fig. 2.) This procedure effectually eliminated the possibility of absorption from below this point. The application of the tube did not in the slightest degree reduce the boy's resistance which was already at the lowest ebb. The gangrenous arm was wrapped in strong formalin gauze and securely sealed by a rubber envelope. The boy was returned to bed without any appreciable change in his general condition. The skin was protected by rubber cement and the wound Dakinized. In twenty-four hours his pulse was 110, his temperature dropped to 100, and although the inroads of the bacillus aerogenous had been arrested, his condition was extremely bad and death seemed imminent. We therefore ventured to give him 100 c.c. of blood by direct method, using his mother, whose blood matched with his, as donor. A marked anaphylactic reaction followed, notwithstanding which the boy made a slow but uneventful recovery.

On April 4, 1923, fourteen days later, amputation at the junction of the upper and middle third was completed under brachial anæsthesia without removing the patient from bed.

Case II.—Mr. L. J., age nineteen, was seen in consultation with Dr. S. R. Maxeiner, to whom I am indebted for the privilege of its inclusion in this report. He was injured on May 17, 1923, by a circular saw, which cut a deep gash in the axilla. The great pectoral, serratus and latissimus muscles were partially divided, the patient escaping injury to the axillary vessels and nerves. He was seen, after first aid has been rendered, by Dr. H. C. Anderson, who partially closed the wound with adequate drainage. The patient was then referred to Doctor Maxeiner at St. Mary's Hospital, where I saw him in consultation on May 19, 1923. Under gas anæsthesia multiple incisions over the wall of the chest were made both anteriorly and posteriorly. A thorough débridement of all discolored and non-reacting muscle was made. Skin flaps were dissected up to the line where it was estimated future amputation would be necessary and at my suggestion the rubber constrictor applied just beneath the origin of the flaps. In this instance, Doctor Maxeiner suggested making several turns of the rubber tube which I believe is of decided advantage in the procedure as it was found at the time of the completion of the amputation on May 24, 1923, that the muscles, arteries and nerves had been completely and cleanly divided down to the bone. The surfaces of the soft tissues presented a clean granular appearance and it was only necessary to divide the humerus, inject the nerves with alcohol and suture the flaps in place. This patient, like Case I, has made an uneventful recovery.

Case III.—Mrs. S. K. was admitted to the hospital on June 6, 1923, and seen in consultation with Dr. George Gordon. History: Age, fifty-seven. Jewess. Patient began having pain in left great toe five weeks before admission. This gradually became more severe and discoloration was noted a week before admission. Her past history is negative except for cardiac trouble first noted about two months ago, and at this time there was developed speech defect, a drooping right eyelid and blindness in this eye and

a mask-like expression. When seen in consultation the findings were blindness in the right eye, complete irregularity of cardiac rhythm with an apical rate of 180 and radial 140. Moist râles were present in the bases of both lungs. The left great toe showed gangrene with bluish discoloration and there was evidence of poor blood supply over the lower portion of the shin. Digitalis was crowded two days. On June 8, 1923, under local infiltration and sciatic block an attempt was made to do a left femoral periarterial sympathectomy. However, upon dissecting away the outer coat of the artery it was found that the lumen was completely closed by the processes of endarteritis obliterans. It was therefore decided that amputation would be required. The sciatic nerve was identified, severed and blocked with alcohol. It was thought advisable not to proceed further with the operation at this time. The patient was returned to bed. Fluids were forced by hypodermoclysis and digitalis was continued during the next five days. On June 13, 1923, her pulse was 140. Subdermal infiltration with novocain was made. The skin was dissected from both anterior and posterior surfaces of thigh and turned upward. Beneath the skin flaps the rubber tourniquet was applied tightly without further manipu-

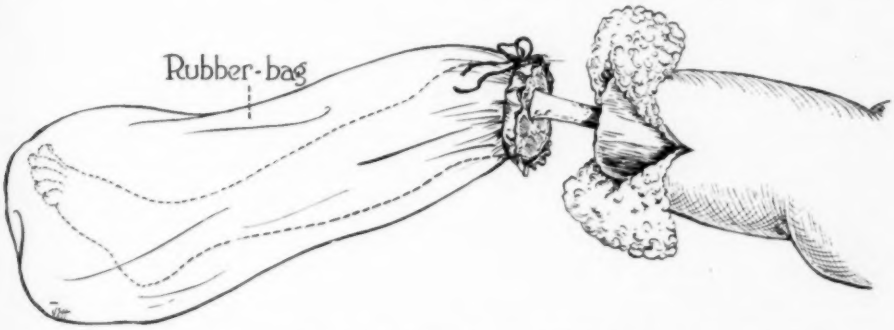

FIG. 3.—Case III. Amputation of soft tissues resulting from application of tourniquet.

lation and the patient was returned to bed. Five days later without removal from bed the amputation was completed, the only requirement being a small amount of novocain in the muscle tissue proximal to the tourniquet. (Fig. 3.) The femoral nerve which had not been identified previously was identified and blocked with alcohol. The femur was divided without pain. Dakin's tubes were inserted and the skin flaps closed loosely. At this time pulse of patient did not go above 120. There was practically no hemorrhage. The next day the white blood count was 15,000 and hæmoglobin taken at this time was 38 per cent. During the next five days there was slight sloughing of the skin flaps which were unnecessarily long and the wound remained clean with Dakinization. However, on the twenty-fourth, sixteen days after the primary operation, while being changed in position by the nurse she suddenly collapsed. Pulse became very rapid and irregular. Temperature rose to 102. She became unconscious and did not regain consciousness. The left arm became limp and the patient died on June 25th. An autopsy could not be secured. In the writer's opinion this patient could not have survived the amputation by the classical method even under local anæsthesia. It was thought that death resulted from central thrombosis.

Remarks.—The application of the rubber tube presents, it seems to me, a wide range of possibilities. It gives one a shockless, painless, quickly executed method of dividing all the tissues of a limb excepting the bone. It therefore presents all of the advantages of immediate amputation without its disadvantages. The absence of pain was a striking feature of the convalescence in Cases I and II. In Case III the patient was semi-delirious and

complained almost constantly as would have been the case under any form of treatment. While one sees reports from time to time that the nerves should not be constricted by ligatures, etc., because of resulting post-operative pain, it is well-known that marked constriction of a nerve is one of the time-honored and effective means of producing anæsthesia. The effect of this method upon the liability to secondary hemorrhage is more or less problematic. The analogous use of pressure upon the vessels in other fields of surgery would seem to indicate that secondary hemorrhage would be less liable to occur than when the orthodox method is employed. In these cases a rubber tourniquet was kept in readiness for this emergency, which however did not present.

LACK OF OPERATIVE INDICATIONS IN ASTHMA AND OTHER FORMS OF ALLERGY

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The value of statistics in this connection cannot be over-estimated. My impression always was that patients suffering from asthma and other forms of allergy, were operated upon too much, but I never realized to what extent until I had compiled the statistics herewith submitted. Of three hundred patients 30.4 per cent. were operated upon. We must bear in mind that a good many of these patients were young children who have escaped the surgeon's knife thus far, only because they have not lived long enough. An even larger group of patients have thus far escaped operations because as yet the doctors have not succeeded in overcoming their fears or convincing them that they really will be benefited by operative procedure. I dare say before the life's cycle of these three hundred patients is over, the 30.4 per cent. operated upon will be materially increased, by recruits gained from the last two groups. Yet not a single patient was cured by any of these operations. Sometimes the shock of an operation in these patients will so alter the autonamic nervous system which is really at the bottom of this disease,[1] that a temporary improvement will be obtained. The surgeon need not congratulate himself, however, that this particular operation was indicated; any other operation would have accomplished the same result. Even in these rare cases, I believe surgery is not indicated.

Table I

Total No. of Cases 300

Operations performed:—

Appendectomy	17	Throat	33
Miscellaneous	29	Nose	28
Female generative organs	13	Angio-Neurotic-œdema	1
Total No. anatomical operations	121, or 40%	Combined operations	17

Total No. patients operated upon ..... 104 or 30.4%

As Table 1 indicates the operations anatomically only, and does not indicate when the patient was operated upon repeatedly in the same region, the actual number of operations performed is really much greater. One patient was operated upon the nose and sinuses thirteen times, and yet is listed as only one. The operations by the dentist on the mouth—removal of teeth—operations for pyorrhœa, etc., in an effort to cure asthma, these operations are not listed.

TABLE II

	Throat	Nose	Appendix	Female genitalia	Miscellaneous
Throat Operations	0	5	3	0	1
Nose	5	0	2	1	2
Appendix	2	1	0	3	0
Female Genitalia	0	1	3	0	0
Miscellaneous	1	2	0	0	0

Out of 104 patients, 17 had more than one kind of an anatomical operation. The above table shows this combination.

NOSE AND THROAT

Operations on the nose and throat, and sinuses seem to be by far the most popular operation in allergy, particularly in the manifestation of asthma, and hay-fever. Fifty-six patients or 18.7 per cent. in our series of three hundred cases underwent these operations, a good many of them more than one time. One patient was operated upon thirteen times. In fact in this region multiple operations seem to be the rule rather than the exception. Patients told me repeatedly, that the reason they have not as yet consented to this fashionable operation, was because they knew that one operation meant more in the future. From my experience I believe they are right. When the patient is not relieved, as he is sure not to be, by the operation of the first surgeon, he tries another, who finds further indications for operations. The result is that the more surgeons they see the more operations they have. The popular operations in this region are particularly tonsillectomy, adenoidectomy, turbinectomy, operations on septum, spurs, polyps, and sinuses.

I believe that the great majority of these patients belong to the group of status-thymo-lymphaticus and normally have an hypertrophy of all the lymphatic tissue and should be left alone. Very often the operations on the nose and throat in these patients take on a wholesale character, every member of the family is operated upon. The removal in these cases of hypertrophied tonsils does no good. It is surprising to see how the indications for operation in this region disappear [2] if you relieve or cure the asthma by means of allergic principle, *i.e.*, determine the allergin, eradicate it; if this is impossible, desensitize the patient. Only one patient was relieved of the asthma for a period of three years, a few for a few months, the rest not at all. Many patients gave a history that nose and throat operations aggravated their conditions.

I am very well acquainted with the theories that prompt surgeons to undertake operations in this region for the relief of asthma and hay-fever—removal of focus of infection, and reflex irritation, source of sensitization, increase breathing space, etc. Practically, however, this does not work out, because the patients are not benefited by these operations. As the result of my experience, I believe that operations on the nose and throat for the relief of any of the manifestations of allergy should be completely abandoned.

TABLE III

The number of operations performed on the three hundred patients by the time they reached certain ages.

Age	No. operations performed anatomically	Age	No. operations performed anatomically
0 - 9 -	14	40 - 49 -	29
10 - 19 -	10	50 - 59 -	5
20 - 29 -	28	60 - 69 -	0
30 - 39 -	21	Age unknown -	4
			120 Anatomic

Angioneurotic Œdema.—One patient was operated upon. An incision was made into the swelling which occurred at the side of the nose and beneath the eyes. When this recurred some time later at the same place, it was quickly relieved by adrenalin injections. I know of another case where a laparotomy for intestinal obstruction was performed for angioneurotic œdema of the small intestine. Angioneurotic œdema may occur not only anywhere on the surface of the body, but also in any of the hollow or solid [3] viscera.

Female Generative Organs.—Thirteen women out of 167 female patients had operations on the female generative organs. The operations were mainly for the various benign tumors which occur in the ovary and the uterus, cysts, fibroids, etc. The removal of these tumors, as well as the eradication of inflammations and infections existing in the cervix, tubes and pelvis, did not in the slightest degree favorably influence the asthmatic attacks of these patients. The characteristic feature of these patients was that their asthma was aggravated at the menstrual period. The operation was undertaken not only for the relief of the pathological condition existing in the pelvis, but also with the hope of favorably influencing the asthma. The rationale of the procedure was that the pathology in the pelvis reflexly produced the asthma. I have yet to see a single case of true bronchial asthma cured by any operation on the female genitalia. Operations on the female generative organs, for the cure of asthma, should be abandoned. Table IV shows the combination of the various manifestations of allergy as they occurred in our three hundred office patients.

TABLE IV

	No. of cases	Asthma	Hay fever	Allergy of the gastro-intestinal tract	Allergy of the skin
Asthma	237		56	49	59
Hay Fever	82	56		33	26
Allergy of the gastro-intestinal tract	95	49	33		59
Allergy of Skin	104	59	26	59	
Asthma alone	118				
Hay Fever alone	6				
Allergy G. I. tract alone	11				
Allergy skin alone	4				

Appendectomy.—Seventeen out of these three hundred cases (6 per cent.) had appendectomy performed. Several times that number were repeatedly advised appendectomy but refused. In none of the cases was appendectomy undertaken with the idea of curing or relieving the asthma although Gutman [4] claims that a chronic appendicitis may reflexly, by irritating the vagal terminations, give rise to attacks of asthma. To prove his point he presses over McBurney's point and elicits in these cases attacks of asthma. By appendectomy he cures his asthma. I could obtain no such results by the former method or in the latter cases. The reason why appendicitis is so frequently diagnosed in these allergic cases is due to the fact that no matter from what form of allergy the patient is suffering gastro-intestinal symptoms are a conspicuous manifestation. Ninety-five patients of our group showed definite allergic manifestations of the digestive tract. This consisted of abdominal pain, distention, sour eructations, belching, constipation or diarrhœa, nausea and vomiting. Tenderness in the right iliac fossæ is a very frequent occurrence in these cases. It is evident that these symptoms may be readily mistaken for appendicitis. The lack of abdominal rigidity and a definite history of allergy is a great help in excluding appendicitis. I have repeatedly, promptly eradicated all digestive disturbances of years' standing by merely determining by skin tests the noxious agent and eliminating the allergic food from the diet. Operations in these cases fail to relieve the gastro-intestinal symptoms.

The appendix is removed indiscriminately for a multiplicity of diverse conditions. A thorough study before operation would have saved these patients needless surgery. Any and all of the various manifestations of allergy is very frequently associated with indigestion and right-sided pain.

Miscellaneous Operations.—Twenty-nine (9.66 per cent.) patients were operated upon for miscellaneous conditions. These consisted mainly of hernias, hemorrhoids, duodenal ulcers, tumors, abscesses, etc.; these operations were not undertaken with the object of relieving the various manifestations of allergy. Two hundred and thirty-seven patients out of our series of three hundred cases had asthma. In a good many of our cases the continuous straining and coughing and the venous stasis which accompanies asthma was responsible for the hernia and hemorrhoids. I believe that this explains the rather high number of miscellaneous operations in this disease as compared to other chronic non-operative diseases. To my mind all these operations were perfectly legitimate and should have been performed.

CONCLUSIONS

(1) A large number (30.4 per cent.) of asthma and other forms of allergic patients are operated upon. Most of these operations are needless and useless.

(2) Nose and throat operations are the ones most frequently performed. The benefit derived from these operations is negligible, and should be abandoned for the cure of asthma and hay-fever.

(3) Indigestion of allergic origin is frequently mistaken for appendicitis.

(4) Patients who were operated upon the pelvic organs failed to derive a cure or the slightest benefit from their asthma or hay-fever.

(5) As these patients were operated upon not by any one surgeon, or in any one hospital, but by surgeons and hospitals generally, the final results justify the conclusions that we have no operation up to date which will cure or even benefit asthma or hay-fever.

(6) It may be argued that these cases represent only the operative failures, those cured I do not see. This reasoning is fallacious since none of these operations render the patient immune from further sickness. I would have obtained from patients the definite history that operation eradicated asthma or hay-fever. Thus far I have obtained no such history.

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TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held February 4, 1924

The President, Dr. John H. Jopson, in the Chair

AN AUTOGENOUS CONTROL OF THE OPERATION OF SYMPATHECTOMY

Dr. Henry P. Brown, Jr., presented a man, forty-one years of age, who was admitted to Doctor LeConte's service at the Pennsylvania Hospital on February 14, 1922, complaining of constant pain in the left great toe which had been present for three or four months before admission. During the four weeks preceding admission there had been swelling of his foot. He was a well-nourished, well-developed man, showing no demonstrable pathological changes aside from the condition of his legs.

The pulsations in the femoral arteries were palpable below Poupart's ligament on each side. No pulsations could be felt in the popliteal, anterior or posterior tibials on either side. The toes of the left foot were of a dusky pinkish color, and pressure showed a slow filling of the capillaries. The discoloration was more marked in the great toe, and it was in this one that the pain was most severe. The change in color extended to the mid-metatarsal region. The toes of the right foot showed the same type of discoloration as on the left, but to a much less degree, and there was no pain on this side.

February 24, 1922, under nitrous oxide anæsthesia, Doctor LeConte performed a sympathectomy on the left common femoral artery without encountering any technical difficulties. The relief from pain in the toe followed almost immediately, and in the course of a week or ten days there was a decided improvement in the circulation of the foot, to such an extent that it appeared even better than the right one.

In view of the fact that such an improvement had followed sympathectomy, Doctor LeConte urged the patient to allow the right artery to be operated upon, but this permission was refused for reasons best known to the patient himself.

Upon his discharge, March 24, his condition was recorded as being very much improved on the left side, and unchanged on the right.

In January of 1923, ten months after leaving the hospital, he was readmitted, complaining of pain and discoloration in the right great toe, and examination showed that gangrene had already appeared in this toe and the others of the same foot were of a dusky pinkish-blue color. The left foot showed a moderate discoloration extending to the mid-metatarsal region, but not nearly as marked as on the right side, and it was free from pain. He said that the left foot, the side upon which he had been operated, had been free from pain ever since his operation. He was extremely anxious to have a sympathectomy done on the right side, but in view of the fact that gangrene had already appeared in the great toe on this side, Doctor LeConte did not entertain much hope of relieving his condition. It was decided to give him the benefit of the doubt, and accordingly a sympathectomy was performed on the right femoral artery, just below Poupart's ligament, January 27, 1923. On expos-

ing the artery it was seen to be very sclerotic and the phenomena of contraction of the vessel after removal of its adventia, as mentioned by LeRiche, was easily demonstrated.

The relief from pain was almost immediate, but it was not followed by the improvement of the circulation which had followed operation on the left side. The gangrene of the right toe progressed and a line of demarcation having formed, it was amputated without an anæsthetic March 6th. Pathological examination showed almost complete obliteration of the vessel and great thickening of the walls.

By March 12, six days after removing the great toe, the gangrenous process had involved the second and third toes, and amputation of the leg was advised. March 22 this was done, the leg being removed at the junction of the middle and lower thirds. The notes at the time of operation state that there was practically no bleeding. The patient had insisted upon saving as much of the leg as possible, hence its removal at the lower rather than the upper third. Pathological examination of the tibial vessels showed marked thickening of the intima, but no fibrosis or calcification. One isolated portion of the dorsalis pedis showed a lesion of the arterial wall in the form of a circumscribed area of necrosis, involving the intima and media. There was actual caseation in the periphery of this lesion and a diffuse collection of polymorphonuclears in its centre.

April 22, the notes state that the flaps were sloughing but the patient's morale was much improved. He had been having attacks of marked depression. The sloughing gradually subsided and the stump healed over with granulation tissue, till at present, February 4th, there is a small granulating area approximately one and a half by two centimetres in extent.

The progress of the left foot has been most interesting. Upon two or three occasions during his present stay in the hospital the discoloration has become quite marked, lasting over a period from one to two weeks. At one time after wearing a shoe which was slightly tight, it appeared as though the toes would become gangrenous. With rest in bed, however, and constant heat (electric light) to his foot, the condition greatly improved. At present he spends most of his time in a wheel chair and on crutches, and as you can see, the foot is in fairly good condition.

This is the first case to come under their observation in which they have had what might almost be called an autogenous control of the operation of sympathectomy. While they have not had a sufficiently large number of cases of sympathectomy at the Pennsylvania Hospital to warrant drawing any conclusions, yet they feel that this operation has been an important factor in the preservation, up to this time, of the left foot of this man. Whether the improvement will be permanent or not, at the present time they have no means of telling.

CERVICAL LYMPHADENITIS SIMULATING A TUMOR

Dr. Astley P. C. Ashhurst presented a further report in the case of the patient who was shown at the meeting of the Academy, October 1, 1923 (Annals of Surgery, 1924, vol. lxxix, p. 133). This patient returned to the Episcopal Hospital in January, 1924, and a few indolent lymph-nodes adjacent to the scar of the operation on the left side of the neck were excised. Histological examination of these, and further examinations of the original specimen by Dr. C. Y. White, failed to reveal any indication of malignancy, as suggested by Doctor Nassau in his discussion of this case. Doctor White

found merely chronic inflammatory tissue without evidence of any specific histological changes.

PROSTHETIC APPLIANCE REPLACING ONE-HALF OF LOWER JAW

Dr. George M. Dorrance presented a man, who after having been operated upon twice by the late Dr. Francis T. Stewart for multilocular cyst of

Fig. 1.—Prosthetic appliance for replacing one-half of lower jaw.

jaw, first operation, nine years ago, and second operation seven years ago, in both of which operations the cysts were excised by the intrabuccal route,

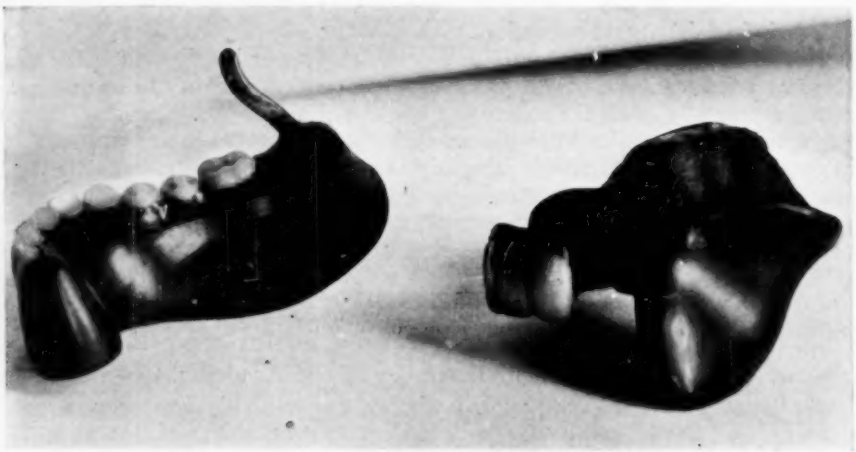

Fig. 2.—Prosthetic appliance for replacing one-half of lower jaw.

had developed recurrence one year ago. Upon examination six months ago, practically all of the left half of the lower jaw was involved. X-ray studies by Doctor Dassell confirmed the diagnosis. Patient was operated upon several

months ago and brought before this Society. At that time the importance of leaving intact the genio-hyoid muscles on both sides was pointed out. This patient is now perfectly comfortable and is able to masticate his food, with appliance which Doctor Dorrance demonstrated (Figs. 1 and 2). The principle of the apparatus is the old double incline plane.

MOBILIZATION OF ANKYLOSED JOINTS

Dr. W. S. Baer, of Baltimore (by invitation), addressed the Academy on the question of the production of motion in ankylosed joints, joints which are really ankylosed and where the fibrous tissue is so dense in amount that no motion is allowed and not joints which are only partially ankylosed and in which various methods may give good results. The subject narrows itself to one of arthroplasty. For arthroplasty at first many things were used as interposing substances between the joint surfaces so that the bone would not grow together again; both organic and inorganic substances were used and both living and dead material. Nowadays only three methods of producing arthroplasty are in use: interposition of fascial flap free transplant, interposition of fascia and fat transplanted with living pedicle attached to it, or by organic material.

The membrane which the speaker had used for reasons he had demonstrated is made up of pig's bladder, chromicized to remain *in situ* fifty or sixty days. It does not make any difference which material is used; the free fascia, the fascia and fat with the pedicle, or the membrane. The pathology is the same.

It is said that free fascia when transplanted dies and that fascia and fat with the pedicle dies, but pigs' bladders do not have to die. In the interposition it is a question of the production of connective-tissue cells, which after a while show no tendency to unite with the layer on the opposite side of the joint.

Arthroplasty was first done on a series of cases in which it was done in the hope of saving life. Consequently, these first were for ankylosis of the jaw, congenital, or produced from disease at an early period of life, where disuse of the joint occurred and where the child could not be properly nourished because it could not swallow. But now arthroplasty has been solved for practically all parts of the body unless it be the knee-joint and the small joints of the hands and feet.

The knee-joint offers a problem which is gradually, although not yet completely, solved. The intimate anatomical relation of the tendons of the small joints of the body makes it difficult for arthroplasty because the range of motion is small and the tendons are so close to the joint that one is apt to get adhesion between the tendons and the small joints. But in all such joints as the jaw, shoulder, elbow, ankle, and hip, arthroplasty has come to stay. It is a proper operation in which one can almost with certainty predict the result.

The speaker then reported the results obtained by him during a period of about 15 years, comprising about 250 cases of arthroplasty on various

joints of the body. Being enthusiastic over the treatment, he had tried it on many tubercular cases which had failed, so that the result is not so good as if he would take only the last five or six years. The general result, however, has been good—serviceable motion being obtained in 78 per cent. of the cases operated on. At one time he had trouble with the pig's bladder material because he had not learned to what extent chromic acid was evulsed from certain joints. That membrane which he now uses lasts only fifty days, and he had rarely had evulsion since of the membrane. He prefers to use the membrane because he thinks it is easier than the fascia, also it is always put up and ready for use and is the same consistency throughout. Sometimes when one removes fascia one has to take a larger piece than is needed in order not to interfere with some part of the anatomy; also a hernia in the fascia lata is not an unheard of thing.

In his series there are 46 cases of true ankylosis of the jaw, with one failure and one death—a case he should not have tackled, a child with congenital synostosis clear down to the molar teeth. Two other children died of the same thing. The child only weighed 3 pounds, although a year old, and the operation failed. In the other cases the result was perfectly satisfactory, whether single or double jaws. The mode of operation was simply a small incision underneath the zygoma. All one has to do is to be careful in the retraction not to pull too hard on the branches of the smaller nerves. There was some temporary fascial paralysis in 18 per cent. of the cases, but never a permanent paralysis. The next thing is to divide down the masseter muscle in a longitudinal manner and expose the bone. Make an incision in the periosteum and shove back on both sides, the operation being done subperiosteally, leaving the branches of the temporal muscle. Sometimes the condyle and the coronoid process are both involved. If the condyle alone is involved, take it off, but if both are involved, remove both pieces of bone; done subperiosteally, there is no danger of hemorrhage. The membrane is drawn directly around in a purse-string fashion and the skin closed up and the operation is finished. He never does two sides at one sitting and usually allows three weeks to elapse before doing the second stage.

In simple cases of undershot jaw, the chin is deflected to one side. The patients feed themselves. In some cases will be noticed a slight paresis of the facial nerve on one side, showing the eye also more open than is normal.

In one case arthritis had developed late in life. At the age of eighteen following the infection of a tooth, it, the infection, went to the jaw and surrounding structures. Sometimes people go through life with ankylosed jaws and when they go to have their teeth fixed, discover that the work can not be done because their mouths can not be opened. He had operated on both jaws for arthritis deformans with the result that five years later the man had the same amount of motion which we secured by operation.

In cases of ankylosis of the shoulder and elbow. Three cases of ankylosis of the shoulder in his series had resulted in two successes. In eight cases of ankylosis of the elbow there were 72 per cent. with good motion; one

case had a double ankylosis of both elbows. This case was operated on by Doctor Bennett and himself, he doing one elbow and the reporter the other. Five weeks after the second operation, the man can come up to almost normal level in pronation and supination.

The difference between resection and arthroplasty is the greater stability, the greater power and the more normal action in the joint itself secured by arthroplasty. Of course one can get good strength from resection of the elbow and good results but always there is lateral motion and the result is not good cosmetically.

Ankylosis of the hip-joint is another question and in certain cases one will almost always be able to guarantee that normal function in the joint itself will be obtained. He would avoid interfering in tuberculous cases because only fifty per cent. of cures had been obtained in tuberculosis of the hip, while in the other fifty per cent. one probably lights up the tuberculosis again in doing arthroplasty.

He would not operate in cases of hip disease due to infectious arthritis. One is not sure in arthritis deformans that the disease is over.

The procedure advocated by the speaker is the incision from the anterior superior spine around the trochanter to the sacro-iliac notch. The trochanter is cut with a broad chisel. Sometimes it is hard to tell where the acetabulum begins and one has to guess at the point where the ileum stops because there is new bone. Sometimes one does the arthroplasty on the end of the bone and sometimes on the ileum itself. Generally, one finds some small line of cleavage, and can chisel in between it and the acetabular cavity itself. Then separate and dislocate the head of the bone fragments, and file off the head until it is perfectly smooth and having done that, cover the head with the membrane entirely and sew the membrane into the fibrous tissue along the lines of the trochanter; replace it in the fragment, turn it down near the shaft and close the wound perfectly with silver wire. He leaves it in for six, eight or nine weeks as the case may warrant. He puts the limb in extension on a Thomas splint. At the end of three weeks this is removed and the patient is allowed to walk at the end of another week. Massage and hydrotherapy then are used. There have been in the hip cases 32 patients with Neisserian infection with 90 per cent. of cures; by that he meant flexion of 60 degrees was secured. These cases lend themselves very well to arthroplasty, but they should not be operated on until one year after the acute process is over.

Septic cases are much more difficult than those with gonorrhœal infection. They very often have marked scar tissue. Treatment in these cases is difficult and the reasons to his mind is the one which has not allowed him to go further in the knee-joint than he has up to the present. In the elbow cases, motion is the great thing, in the hip-joint, motion and stability are necessary, but in the knee-joint, stability must be had and also good motion. He divides the knee-joint cases into three groups: those with fibrous ankylosis between the patella and tibia and between the femur and tibia; those with bony ankylosis in one or the other, and those with complete bony ankylosis. In

the fibrous ankylosis one can usually procure fairly good joints. He had gotten motion in about 80 per cent. of the knee-joints of this type. His own cases show only 22 per cent. of good motion where complete bony ankylosis had occurred. The knee-joint question is not so much the solving of arthroplasty as it is the solving of the question of interference with the soft parts. In association with the operation of arthroplasty he had been lengthening the triceps muscle by suitable incision and in sewing up he did not bring the quadrilateral muscle up to where it was before; he also takes out all the scar tissue around the joint itself. If it is left, motion is interfered with.

In conclusion he said that arthroplasty of the shoulder, jaw, elbow and hip, is an operation that can be perfectly well offered to the public. Arthroplasty in the knee-joint is still in the state of solution but becoming better and better every day as one recognizes difficulties in the periarticular tissue. The small joints should not be subjected to arthroplasty.

Dr. Astley P. C. Ashhurst said that he would not attempt to compare his results with Doctor Baer's, as he has had so many more cases: excluding arthroplasties of the jaw, for every one of his own cases of arthroplasty Doctor Baer has done ten, 200 to 20. His own results had been as follows:

Arthroplasty	Total	Good	Bad	Per cent.
Elbow	8	5	3	37.5
Hip	8	4	4	50
Knee	4	2	2	50
	20	11 (55%)	9	(45%)

	Total	Good	Bad
Excision of elbow (ankylosis, etc.)	8	7 (87.5%)	1 (12.5%)

	Total	Good	Fair	Unknown
Reconstruction of hip (pathological dislocation)	12	10	1	1

In arthroplasty of the elbow, after doing a number with very good results, he had several in succession in whom ankylosis recurred; so that he had about given up this operation in favor of excision, in spite of the partiality he might be expected to feel for the method of operation described by himself in 1915. In arthroplasty of the hip, the four failures were all on the same patient (two operations on each hip); but the four good results, in patients carefully selected, were so satisfactory that he regards it as an excellent operation. He had done only four arthroplasties of the knee. Doctor Baer says in cases with bony ankylosis he secured good results in only 20 per cent. of his patients. Doctor Ashhurst had had two good results and two bad.

The speaker then presented five patients who had undergone either arthroplasty of the elbow or hip; also lantern slides for the purpose of showing why excision of the elbow is as good as arthroplasty in most cases, and why reconstruction of the hip is more generally applicable than is arthroplasty. As Doctor Baer says, the *indications* for arthroplasty, in the case of any joint, are very limited; and therefore he must exclude a large number of patients who are entitled to relief at the surgeon's hands. No joint in which the normal

contours of the bone ends are lost is suitable for arthroplasty; whereas excision of the elbow and reconstruction of the hip will give very useful limbs even when the joint has been utterly disorganized and deformed. In the knee, where the results are so very uncertain, even in Doctor Baer's own experience, the decision to attempt arthroplasty is very difficult to make, even when the suitable case presents itself.

Dr. DeForest P. Willard said that tuberculosis is distinctly a contraindication to an attempt at arthroplasty, although in certain cases one has to operate in spite of it. Any acute or subacute infection during the time of its occurrence, any joint with marked destruction of the bone or of the soft parts, offers a poor seat for arthroplasty. The ideal case is one in which the ankylosed process has remained very closely localized in the joint itself such as arthritis or traumatic or pathologic origin. Another side not brought out and one of distinct importance is the after-treatment. Arthroplasties do not get well of themselves. They need courage on the part of the patients and the doctors; they need massage to bring back musculature and exercise to prevent further ankylosis. I think more can be done with active exercise than by simple passive motion of the joint. If the patient assists the surgeon, the end result will be better than with passive motion. There is the question of partial recurrence of limitation of motion after four or six months' periods. Many cases have marked improvement during four to six months and then there is distinct return of limitation of motion, not to the degree before arthroplasty but a distinct cutting down of motion.

Dr. Robert H. Ivy said that most of the patients with ankylosis of the mandible that he had seen had been remarkably well nourished and stated that they could eat practically a normal diet. In operating for this condition he preferred the curved incision of Blair. Being largely within the hair-line it leaves less visible deformity, is less likely to injure facial nerve fibres to the occipito-frontalis and orbicularis palpebrarum, and affords easy access to a pedicled temporal fascia flap, if desired, to interpose between the cut bone surfaces.

FRAGILITAS OSSIUM

Dr. George W. Wagoner read a paper on the above subject (Idiopathic Osteopsathyrosis), for which see Annals of Surgery, July, 1924.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting Held February 13, 1924

The President, Dr. Eugene H. Pool, in the Chair

OPERATIVE STEPS IN REMOVAL OF ADVANCED CANCER OF STOMACH

Dr. Willy Meyer presented a man, sixty-four years old, who had come under his care with a very far advanced cancer of the distal two-thirds of the stomach, causing a stricture of the pylorus. There had been pain shortly after the ingestion of food for the last four months; no vomiting; loss of weight, but good appetite and bowel function. Examination showed a palpable growth in the epigastrium. Analysis of stomach contents proved the presence of a carcinoma with food retention. The X-rays corroborated this finding: large residue after six hours with the stomach palpably distended for several inches.

Operation was indicated on account of the continuous severe pain. Permission was obtained from the family to add an operation on the costal arch, should this become necessary in order to reach healthy parts. December 26, 1923, median incision. Stomach widely infiltrated, with multiple cancerous metastases in lesser and major omentum, liver, hepatic ligament and parietal peritoneum. Proximal third of stomach free of tumor, greatly distended, elastic. Gastro-enterostomy alone possible. On lifting omentum plus transverse colon, it is seen that the tumor has trespassed upon the transverse colon and its mesocolon. Only anterior gastro-enterostomy is feasible; but the pouch is away up under the ribs. Addition of transverse horizontal incision to the tip of the left eleventh rib, with raising of costal arch according to Marwedel, as described by Doctor Meyer in the *Jour. A. M. A.*, October 6, 1906, p. 1059. This gives splendid access. Careful gauze tamponade, as stomach seems filled to capacity in spite of prolonged pre-operative lavage. Small puncture with knife; exit of whitish, thick fluid in shape of a spurt. Suction unsuccessful; gradual mechanical emptying of stomach pouch; its wall appears brittle, more than one-half inch thick. Suture anastomosis out of question; use of Murphy button only chance. With some difficulty the anastomosis with a long loop is perfected in front of the transverse colon and a part of the jejunum is stitched over it by means of two mattress sutures; the entire field is then covered with omentum; closure.

First days of convalescence somewhat stormy on account of continuous vomiting; improved by repeated lavage; then uninterrupted recovery with total cessation of previous pains. Button dropped into stomach, as expected; it is there still to-day, seven weeks after the operation, as radiographs show. (Presented.)

A few points of interest stand out conspicuously in this case:

1. Even in far-advanced cases of carcinoma of the gastro-intestinal tract, in the presence of great suffering of the patient, the operation should not be a mere exploration and the abdomen closed without an attempt being made to bring help. He had seen patients of this type live for six to eight months and longer in comparative comfort before they died.

2. In order to give the surgeon a free hand, permission for an additional operation on the costal arch should be obtained.

3. The osteoplastic raising of the costal arch opens the vault of the diaphragm.

4. Murphy's button alone can accomplish a successful anastomosis in an emergency as the one stated above. Its use was clearly indicated here. In anterior gastro-enterostomy it will probably drop into the stomach. However, it is not an absolutely unwelcome guest; the organ after a while gets used to its presence.

The patient is greatly improved and relieved of his former pain. His life will be prolonged and has ceased to be a burden and misery to him.

RESECTION OF THE UPPER RECTUM FOR OBSTRUCTING CARCINOMA

DR. WILLY MEYER presented a woman, thirty-five years of age, who was presented before the New York Surgical Society on March 2, 1922 (see ANNALS OF SURGERY, December, 1922, p. 795, where details can be found). At that time Doctor Brewer expressed the desire to see the patient presented again three years after operation. The time elapsed is now two years and nine months. The operation was done in May, 1921, the combined method being employed, without preliminary cæcostomy, when a thorough clinical examination plus radiograph had shown the presence of a cauliflower-growth in the upper rectum. Left peri-rectal incision; ligation of anterior mesaraic artery right beneath the giving-off of the left colonic artery; tumor, the size of a fist, was found at the bottom of Douglas' pouch, attached to the posterior wall of the uterus and left appendages. It was bluntly loosened and freed all around; sacral cavity entered; temporary gauze tamponade on either side of gut; layer closure of abdominal wound. Patient transferred into knee-elbow posture; long incision in middle line above anus; excision of coccyx and lowest portion of sacrum; bilateral ligature of median hemorrhoidal artery; gauze tampons, put in before, extracted from below; gut freed and pulled into wound with great ease; closure plus drainage of peritoneal cavity; aseptic resection, leaving a rectal stump of about four inches, with the sphincter muscles; gentle stretching of latter; excision of mucosa and invagination of inverted proximal end through this canal; careful stitching in place; dressing. Two and a half days later first change of dressing; closed, projecting stump gangrenous, as expected, a fascia necrosis following, extending above sphincters; gradual recovery. A long-persisting fistula has closed. To-day the patient is in perfect health and in full control of her sphincteric apparatus.

A second, similar, but more advanced case in a female, fifty-three years, was operated upon in the same manner in June, 1922, again without primary cæcostomy. Here the left appendages were more extensively adherent, but general condition forbade simultaneous hysterectomy; a sacral anus was formed; malignant pelvic infiltration was overcome later by deep X-ray treatment. Patient is in good condition so far.

Examination of the tumor in both instances showed adenocarcinoma.

The observation of the two cases suggest:

1. The wisdom of retaining the lower portion of the rectum wherever this can be done. If the distal end of the tumor is well above the anus, the lowest portion of the rectum may be saved, otherwise only the sphincteric apparatus; continuous active training of the latter during convalescence helps in strengthening continence.

2. It seems wise not to have the proximal stump project, nor to close it airtight, not even for twenty-four hours, because with the reduced nutrition

the subsequent distention favors acute gangrene. It seems advisable to amputate the gut in front of the anal ring after it has been carefully stitched in place.

3. To keep the patient in the lateral posture for the first days, in order to avoid pressure upon the intestine that was pulled down.

Dr. George E. Brewer said he was very much impressed with the case of cancer of the stomach on account of the great advance the disease had made before operation and the immense relief brought about by the operation. He had rarely seen such relief as that, but some years ago he had had a case in which the patient gained twenty pounds within seven or eight months. As to the rectal case, he had been anxious to see it because when it was first reported by Doctor Meyer it had been doubtful if the patient would be alive three years afterward, and Doctor Meyer was to be congratulated on the excellent result. These as a class were most unfortunate cases, and the speaker knew of none he dreaded operating on more. Out of 81 cases he had had only four that had gone over four years. The first one, operated on seven years ago was well to-day; one was well for six years; and one for four years; then developed metastasis in the fifth year and eventually died five years and four months after operation. All of the patients that recovered were under forty-one years of age.

Doctor Meyer, in closing the discussion, said he had done this raising of the costal arch three times and had seen the patients make an uneventful recovery. In a case like this one, the full exposure of the proximal portion of the stomach could be made in no other way because it was far beneath the ribs within the vault of the diaphragm. The raising of the arch is best done with the help of an additional transverse incision to the tip of the left eleventh rib. Between the transverse fascia plus peritoneum on the one side, and the rectus muscle on the other, the surgeon quickly and easily advances bluntly toward the costal arch. Branches of the internal mammary artery should be preserved if possible. Then a curved elevatorium is pushed around the broad seventh rib cartilage and the latter divided close to the sternum; outwardly the seventh to tenth cartilage is cut with the knife in front of the bony rib. The skin-muscle flap having been replaced downward, the surgeon's hand takes hold of the costal arch and pulls it up, when the divided portion will yield, sometimes with a peculiar grating noise, and good access can be had up to and posteriorly of the cardia. Others mobilize the costal arch by cutting across below the left twelfth rib well into the belly of the latissimus dorsi, dividing only soft parts. The raising of the costal arch should be practiced more frequently. It will allow radical work in cases seemingly inoperable at first. In this case this patient's life was not worth living; he had so much pain after every meal that he preferred not to eat. To-day he has no pain; enjoys his meals, in fact. Often the patient has a peculiar sensation while eating; evidently, when the button has dropped against the anastomotic opening. The patient then lies down for a moment or two after which he can continue his meal. The point of emphasis is that the surgeon

should not simply close the abdomen when exploratory incision has shown far-advanced carcinoma, and call the case inoperable, but should endeavor to bring about relief.

The rectal case presented had a sinus alongside the sacrum for two years. She had it taken care of with tampons until at last the sinus closed. She is now perfectly well and has full control of her bowel movements.

RESULT OF AN OPERATION FOR THENAR PARALYSIS OF THE THUMB (EXTENSOR-FLEXOR-FLEXOR-PLASTY)

Dr. H. H. M. Lyle presented a girl, ten years old, who at the age of two, while crossing to Scotland with her mother, was almost washed overboard. In saving her, the left arm was forcibly jerked. After this accident

Fig. 1.—Before operation. The left hand is underdeveloped, its thumb is much shorter than the right. The hand shows a characteristic flat palm with atrophy of the thenar and hyperthenar eminences and absence of the thenar creases. Note the helpless position of the thumb as it lies in the same plane as the other digits. Note the slight ulnar contracture tendency in the ring and little finger of the left hand.

her left hand appeared to be useless for grasping and holding objects and she carried her elbow in a flexed position. The Ship's Doctor said: "It was a strain that the child would soon outgrow." Unfortunately the mother took pneumonia and died, so our subsequent history is a blank until the father returned from the war one year later. He found that the elbow disability had disappeared, but the hand was still useless. The father took the patient to a specialist, who said, "that time alone would heal the paralysis." That was seven years ago. There has been no improvement. No history of fever, acute illness or anterio-poliomyelitis could be obtained.

On January 14, 1924, this patient was admitted to Doctor Lyle's service at St. Luke's Hospital for operation. On examination the left hand showed a marked atrophy of the thenar eminence, some of the hyperthenar eminence and slight atrophy of the dorsal interosseous spaces. The left hand is smaller

than the right; the left thumb is markedly smaller and shorter than the right. The palm of the hand is flat and the thumb lies in the same plane as the remaining digits. The thenar crease is absent. (Fig. 1.) X-ray plates of the left hand show the thumb to be smaller and shorter than the right; the radius and ulna of the left to be one-fourth inch shorter than the right; the pisiform very small and underdeveloped. No evidence of old fractures or epiphyseal separations. No cervical ribs. Wassermann negative. The patient cannot pick up or hold objects due to the fact that she cannot adduct her thumb; she lacks the essential pincer action. No sensory or tropic disturbances. It appears to be a pure motor lesion of the ulnar nerve affecting adduction of the thumb.

FIG. 2.—Showing result seven weeks after operation. Note the adduction and the formation of the thenar creases and the restoration of the palmar hollow.

The question naturally arises was it the result of an unrecognized anteriopoliomyelitis; a traumatic root lesion of the brachial plexus; or a local lesion of the deep palmar branch (motor) of the ulnar?

The loss of active opposition is a very serious disability as it interferes materially with the function of the whole hand. Sir Harold Stiles in his work on the "Treatment of Injuries of the Peripheral Spinal Nerves" (1922), p. 166, says: "No satisfactory transplant appears to have been devised to replace the intrinsic thumb muscles whose loss make the digit almost useless as it falls back in the line with the other fingers and is unable to be opposed to them for picking up objects." Stiles recommends, for this condition, Baldwin's operation which is an arthrodesis of the first carpo-metacarpal joint. Doctor Lyle has employed this method and although it gives a thumb capable of picking up light objects, the thumb lacks strength. In our hands better functional results have been obtained by Steindler's flexor-plasty (1918) and by Ney's tendon transplantation (1921). However, the resulting pincer action obtained by these latter procedures has not always been as strong as desired. In an effort to improve this essential action, Doctor Lyle has tried to combine the advantages of the flexor-plasty by Steindler with the good points of Ney's operation.

The operation evolved consists of two steps (extensor-flexor-flexor-plasty): 1. The extensor-flexor-plasty. 2. The flexor-plasty.

1. An incision is made over the extensor brevis pollicis extending from its insertion to a point where this tendon emerges from the posterior annular ligament, the tendon of the extensor brevis pollicis is then divided at this level. An anterior incision exposing the flexor carpii radialis at the wrist is made. The subcutaneous tissue is tunnelled obliquely from the distal edge of the anterior annular ligament to the insertion of the extensor brevis pollicis and the cut end of the extensor brevis pollicis threaded through this tunnel, passed

under the annular ligament and sutured to the tendon of the flexor carpii radialis above the annular ligament.

2. Flexor-plasty. A palmar lateral incision is made over the tendon sheath of the flexor longus pollicis exposing it from its insertion to a point just below the head of the first metacarpal. The tendon sheath is opened and the tendon split longitudinally; the outer half is freed from its insertion and withdrawn from the sheath, the sheath is then closed over the internal half. The external half is carried subcutaneously around the outer side of the base of the first phalanx and sutured. This can be readily done as the previously performed incision for the exposure of the insertion of the extensor brevis pollicis gives an excellent exposure for the flexor anchorage. The thumb is then placed in the functionating position and fixed in plaster. Gentle active movement was begun on the twelfth day; all support removed on the twenty-first day.

It is her left hand. Note how quickly and deftly she picks up small pins from the polished table (Fig. 2), and it is only thirty-one days since the plaster case was removed. Test the snap and power possessed by the left thumb and compare it with the right. This operation has yielded a splendid functionating thumb.

CONDITION TWELVE YEARS AFTER REMOVAL OF CANCER OF STOMACH

Dr. George H. Semken presented a woman who came under observation on March 11, 1912, then aged fifty-one years. She had had symptoms of gastric disturbance for many years, beginning within one-half to two hours after meals and continuing for about one-half to one hour. These were epigastric pressure, slight eructation of gas or bitter fluid, and frequent nausea but no vomiting. There were occasional attacks of a burning sensation in the epigastrium, not relieved by the ingestion of food, but pain was seldom noted. Her appetite was described as ravenous; but despite this, there had been a progressive loss of weight and strength. As additional symptoms, she had had occasional sharp sternal or precordial pain, and there had been two recent hæmoptyses—one, about a tablespoonful of clotted blood three weeks previously, and the other, a grape-sized clot, one week previously. Her father had died from cancer of the stomach at the age of forty-eight years, and one sister had an abdominal tumor, probably a uterine fibroma. No other cases of cancer were known. The previous history was negative. The abdominal findings were practically negative, excepting that occasionally, a small, firm, rounded tumor could be palpated above and to the right of the umbilicus, but not definitely enough for conclusive observations. As additional findings there were (1) a cyst in the isthmus of the thyroid gland, 2.5 cm. in diameter, (2) a mitral regurgitant murmur, (3) a uterine fibroid approximately first-size, with smaller subperitoneal nodules, and (4) a possible tuberculous focus in the apex of the left lung. [Her husband and her son had both died from tuberculosis.]

The analysis of the gastric contents, made by Dr. S. Basch, gave the following data: The fasting stomach yielded one-half ounce of brownish-yellow, alkaline fluid showing a few meat particles. One hour after a test meal of a roll and a glass of water, five ounces of brownish-yellow gastric contents, showing a few blood streaks, was obtained. The solids, quantity three ounces, were mushy and poorly digested. Total acidity, 24. No free HCl and no lactic acid. A few gross and microscopic meat fragments were noted. Examination of the fæces showed no occult blood.

The operation, done on March 18, 1912, consisted in a resection of about three-fourths to four-fifths of the stomach, with a portion of the duodenum, and the related lymphatics, following the technic of Billroth, number two. The abdomen was opened through a right, paramedian epigastric incision. There was no free fluid, and there were no adhesions. The liver contained no metastases. At the pylorus was a firm tumor about 4.0 to 5.0 cm. in diameter, mainly involving the inner wall of the stomach, but extending through all the coats. Slightly enlarged lymph-nodes were noted along the greater curvature, but none were found along the lesser curvature. The pylorus was freely movable. The proposed lines of resection of the stomach and duodenum were marked with black silk threads as guides; and the resection was carried out with the usual care to include the regional lymphatics (the superior and inferior gastric and the subpyloric node groups, along the pancreas). The duodenal section was made about 4.0 cm. below the tumor border. The duodenal and gastric stumps were closed with three layers of suture for each, an inner continuous Connell suture, with supporting Cushing and Lembert layers. A posterior, short-loop gastrojejunostomy (suture method) completed the operation.

The examination of the removed tissue showed a hard, roughly circular tumor at the pylorus, 5.0 cm. in diameter, elevated on the mucous side, and with an excavated centre. The starting point had apparently been in an ulcer at the greater curvature, and extension had occurred along the anterior and posterior walls to make it nearly annular. The microscopic examination by Dr. Francis C. Wood showed an adenocarcinoma, with extension through all the coats of the stomach wall. No metastases were found in the lymph-nodes.

Recovery from the operation was uneventful. The remnant of the stomach began its compensatory enlargement early, and fair-sized meals could be taken within three months. Two months later, the normal full diet as to quantity and kind of food had been resumed. She had an occasional return of the burning sensation and eructation of gas and, at times, sour fluid, but this soon ceased, and she has remained free from symptoms. A recent röntgenogram of the stomach shows the compensatory enlargement of the gastric stump and a well-functioning stoma. Her general condition also is excellent.

Dr. John Douglas said that on looking over his own list of cases of cancer of the stomach he found a record of only seven cases which were, to the best of his knowledge, alive three years or more after operation. One, done in November, 1912, is alive, but now in Denver, with tuberculosis of the lungs. Another case done in 1912, was at last report in 1921, perfectly well, nine years after operation. Another case, seventy-one years of age at the time of operation, died five years later of arteriosclerosis. Two were done in 1919, both of whom are well. One case operated on in 1920 has no signs of recurrence. The last one, done in 1920, unquestionably has recurrence at the end of three and a half years. Doctor Semken's remark that a patient, in whom he had removed three-fourths of the stomach, complained of hyperacidity for two or three years, was worthy of note, because it was the general impression that patients who had experienced these extensive resections never had acidity.

Doctor Semken, in closing the discussion, said that an important technical detail, in gastric resections for carcinoma, is the removal of the part of the

great omentum related to the excised segment, because of its lymphatic connection with the cancer field. It is liberated from the transverse colon by an incision along the margin of attachment; and this is practically bloodless.

LATE RESULT AFTER OPERATION FOR CANCER OF TRANSVERSE COLON AND STOMACH

This case presents two points of interest—one, the failure to make an early diagnosis of cancer of the colon, even with expert X-ray examination, and the second, the value of attempting the surgical cure of an advanced and apparently hopeless case of intestinal cancer.

DR. GEORGE H. SEMKEN presented a woman, now aged forty-nine years, who came under observation on March 1, 1920. Four months previously, she began to have attacks of cramp-like pain down the outer side of the left lower extremity, which continued for about one month. Following this, she began to have frequent colicky pains in the abdomen, and discomfort from gas eructations, borborygmi and flatus, most marked for about fifteen minutes after eating but occurring also at other times. Her appetite remained good and the bowel movements were regular and normal; but there had been a progressive loss of weight and strength. No other symptoms were observed. In the family history it was noted that her mother had died at the age of twenty-eight years, from cancer of the breast following a suppurative mastitis; but no other cases of cancer had been known. A tentative diagnosis of probable carcinoma of the intestine was made; but a comprehensive X-ray examination by meal and enema, *via* fluoroscope and films (partly stereoscopic), failed to show any significant filling defect or obstruction. A later study of the plates, however, based on the operative knowledge of the site of the disease, showed that a slight but definite deformity in the outline of the colon at that point, had not been recognized as a pathological change.

The patient remained under observation for a few months, during which time she showed some improvement from medical treatment. Six months then passed without a report from her; but even at that time, January 21, 1921, there had been no appreciable change excepting a slight constipation. She had not lost more in weight, the appetite was excellent, there had been no discomfort after meals, and colics were not of daily occurrence. They were noted usually about one hour after eating, or at the time of the bowel movements. After another interval of nearly five months, she again came under observation, and at that time, June 15, 1921, a positive diagnosis could be made. The abdominal colics had continued, but they now began in the epigastrium and extended downward, usually ending in the passing of flatus. There was a bowel movement once in two days, but the fæces seemed normal. No mucus or blood had ever been noted. She had had no gastric disturbance, nevertheless there had been a reduction in weight in these five months from 101 pounds to 93 pounds. Examination then showed a palpable firm mass in the abdomen, approximately 6.0 cm. in diameter, at the left of the umbilicus and behind the outer border of the left rectus muscle. The X-ray examination of the colon by enema, showed a definite filling defect in the transverse colon just proximal to the splenic flexure.

Operation was done on June 22, 1921, under a light narcosis of nitrous oxide gas and oxygen, with the addition of a small amount of ether. The abdomen was opened through an upper left rectus incision, and a tumor, approximately 6.0 cm. in diameter, was found in the transverse colon just

proximal to the splenic flexure. It had completely encircled the transverse colon, obliterated the adjacent gastro-colic omentum, invaded the wall of the stomach at the greater curvature, and had become fixed to the anterior abdominal wall over an area of approximately 1.5 cm. diameter. Enlarged lymph-nodes were found along the middle colic vessels down to the pancreas. The liver seemed normal, and there was no ascites. The procedure followed was the block removal of the tumor mass and related nodes, with the resection of the invaded regions of colon and stomach. A circular incision about the anterior abdominal adhesion, dividing the peritoneum and fascia, liberated the mass from the abdominal wall. The splenic flexure and descending colon were mobilized by dissection, after division of the phrenico-colic ligament and the lateral peritoneum; and tapes were tied about the colon, through small openings in the mesocolon, at safe distances proximal and distal to the tumor. These tapes served also as guides and as tractors during the operation. With this preparation, the tumor mass could be lifted out of the abdomen, and an effective walling off with laparotomy pads could be done. The transverse mesocolon was fully exposed by upward traction on the colon; its peritoneum was incised from each tape down to and across the spine; the related lymph-nodes and fatty tissue were dissected from the surface of the pancreas; and, after ligature of the vessels, the transverse mesocolon was divided at its attachment to the posterior abdominal wall. The colon and tumor mass was then drawn downward on the abdominal wall to expose the stomach and the gastro-colic omentum. Beginning at the line of each tape, ligatures were placed in this omentum, close to the greater curvature, ending at safe distances proximal and distal to the tumor, and the gastro-colic omentum was divided through this extent. Flexible intestinal clamps were then applied to the colon at the proposed lines of section next to the tapes, and the colon was divided at those points. The exposed lumen was cleaned with 2 per cent. lysol solution, and the intestinal ends were wrapped in moist gauze. Finally the whole tumor mass was raised vertically to expose the stomach wall, a Kocher clamp was applied along the greater curvature at a safe distance from the tumor, and the excluded segment of the greater curvature was cut away. The tissue removed thus comprised the tumor with the related segments of transverse colon, splenic flexure and stomach, the gastro-colic omentum, the transverse mesocolon with the related lymph-nodes, part of the great omentum, and a small segment of the anterior parietal peritoneum and fascia. The opening in the stomach was closed with fine chromic catgut in three layers—first a continuous Connell suture, then a layer of interrupted Lembert seromuscular sutures, and thirdly, a continuous Lembert. The colon was reunited in an end-to-end anastomosis, which had been made possible by the mobilization of the descending colon. Two layers of fine chromic catgut were used—an inner continuous Connell suture and an outer continuous Lembert seromuscular layer. In the technic of the anastomosis, the colon ends were cut obliquely to give a wider lumen (Madelung), and to avoid the cutting of the blood supply from the edges (Lockhart Mummery). The clamps were applied in slightly different axes, to keep the mesenteric borders from coming opposite each other in the suture line (C. Mayo). Infection of the triangular mesenteric space was made less likely by closing this space with a hæmostat and ligature (Horsley). Finally, through a small McBurney incision, in the right iliac region, a temporary "gas fistula" was established by inserting a small rubber tube into the cæcum, and forming a channel of intestinal wall about it by Kader's method of suture.

Recovery was uneventful and singularly free from discomfort. The wound healed per primam, and there was no leakage from the cæcostomy when

the tube was removed, ten days after operation. She has remained well and has gained 28 pounds in weight.

The examination of the tissue removed showed an annular adenocarcinoma of the colon with invasion of the stomach wall. Metastatic deposits were found in two of the related lymph-nodes. The anterior abdominal wall adhesion was inflammatory in origin, and the parietal peritoneum showed no carcinoma.

DR. WILLY MEYER said that he had done the simultaneous resection of stomach and transverse colon for carcinoma in a younger man several years ago. The patient made a good recovery and was presented before the Surgical Society. He went to South America, later on, where he died, as far as could be learned, about eighteen to twenty months after operation. A few years ago a well-known specialist in X-ray therapy, from abroad, was in this country and visited the Lenox Hill Hospital. The surgeons there wanted to show him what final results had been obtained in the operative treatment of cancer, and it was amazing to find how large a number of evidently cured cases were gathered together in a short time. If all surgeons had had a follow-up system many years ago, it could doubtless be proven that many cases have remained cured for many years. The main cause of the failures is that these patients come too late to the surgeon, but even then the surgeon should not hesitate to remove the growth as long as the case appears operable.

TRIFACIAL NEURALGIA

DR. JAMES H. KENYON presented a woman, fifty-one years old, who began to have pain in the right side of her face, twelve years ago, referred to the third division of the fifth nerve. During the next five years, four operations were performed, as these were done in a neighboring city, there is only her statement as to their character. Apparently they were neurectomies, two on the third division behind the angle of the jaw, one on the infra-orbital and one inside the mouth. The last one, inside the mouth, gave relief for one year; none of the other three gave any relief at all.

September, 1919, she came to the Neurological Institute and received an injection of 85 per cent. alcohol with 2 per cent. novocaine in the third division and had relief for nearly two years. Then the pain returned, but this time in the second division, which was injected; relief for one year. Then pain returned in the third division, which was injected; relief for eleven months, when pain returned in the second division; this was injected, but no relief.

December 18, 1923, she was operated on in the Neurological Institute. The root of the gasserian ganglion was cut, no attempt made to save the motor root. Patient made a good recovery, left the hospital on the tenth day, no complications, complete anæsthesia and analgesia of the entire distribution of the right fifth.

DOCTOR KENYON presented also a man, forty-nine years old, who in 1910 had his first attack of pain, referred to the "eye tooth," left side. Attacks became more frequent and more severe and in 1918 he received his first alcohol injection, second division, left side; relief for eight months. The following year the infra-orbital was resected; relief for ten months. This injection and operation were done by another doctor. October, 1920, the patient came to the Neurological Institute with severe pain in both the second and third divisions, left side. These divisions were both injected 2 c.c., 85 per cent.

alcohol, with 2 per cent. novocaine in each. Relief for seven months. The next injection gave relief for five months. The following twelve injections gave scarcely any relief, the pain became more severe, one attack quickly following another. In the two years, 1920 to 1922, he received a total of fourteen injections.

September 11, 1922, he was operated on in the Neurological Institute. The root of the ganglion was cut. He made a good recovery, left the hospital on the eighth day. There were no complications, complete anæsthesia and analgesia over the second and third divisions, but scarcely any change over the ophthalmic division. Probably a few fibres in the root were left uncut, as there had never been any pain in this division; it is in a way rather fortunate, as the danger of eye complications are practically nil.

To obtain a clear operative field, free from blood and cerebrospinal fluid, we have found continuous suction very helpful. Regardless of the position of the patient, slightly elevated or sitting upright in a dental chair, a few drops of fluid in the bottom of the wound obscures the structures the surgeon's are working on; this can be continuously removed by the suction without interfering in any way with the operation by the use of a small metal tube, soft copper, that can be curved to best fit the wound. About one-eighth inch in diameter and eight to ten inches long. It may be interesting to note in this connection that the first time that continuous suction was ever employed in this manner was in April, 1906, by Dr. Frank Hartley, and the reporter in an operation for the removal of the gasserian ganglion at the New York Hospital. Suction was produced by using a steam ejector on the high-pressure steam pipe. At the present time nearly every hospital is equipped with some form of suction.

These two cases show that alcoholic injections will give as much relief as any of the neurectomies, either intra- or extra-cranial, are easy to give, can be repeated many times, are practically free from complications if carefully given, and should be the choice of all palliative methods.

The only cure is the operation for dividing the root, and this, with its low mortality and comparatively slight risk to the eye, should not be postponed too long.

Dr. Alfred S. Taylor said that the question of alcohol injections is always of interest, but there are many who feel that they are not very serviceable for permanent treatment. At the Neurological Institute they have found that there may be relief for six or seven months and occasionally a case shows relief for as much as two years; but most of them are not relieved for any great length of time, and after a number of injections the intervals of relief are shorter, so that the major operation is regarded as the more satisfactory method of treatment. It would seem that if these patients are young when the neuralgia begins, one might do one alcohol injection, as much to verify the diagnosis as to give relief, for in many cases it is difficult to differentiate between true tic and an affection associated with somewhat similar pain and latter attributes of the involvement of the sympathetic nervous system. Every surgeon who has had many of these fifth nerve cases comes a cropper on some one case (not a true tic), which becomes his nemesis for the rest of his life, for while division of the posterior root gives complete insensibility of the fifth nerve area; the patient complains of pain as great if not greater than before. This happened more frequently before the desirability

and methods of differentiating were as well understood as now. It is advisable first to do an alcohol injection, and if this does not give relief then we are not dealing with a true uncomplicated tic and the major operation should not be attempted. If relief is experienced by the patient, then the major procedure will make complete relief permanent. In elderly people where death may intervene before the relief following the alcohol injection cases, one may consider the alcohol injection the method of choice. But even here there is room for argument because with most of the cases done now one can use local anæsthesia, so there is little shock or pain even to a patient in the eighties, and one can give them complete relief. One old lady of eighty-two chose the alcohol injection for the first attempt, taking the chance of not surviving long enough for a recurrence, but at the end of two years she underwent the major operation and has had no pain since that time, over five years ago. One can give them relief with local anæsthesia. The amount of suffering from an alcohol injection is more than that experienced from the major operation if the local anæsthesia is well given. The amount of hemorrhage is one-half what it is with general anæsthesia. One of the speaker's patients, a woman, became so nervous that he could not continue the local anæsthesia and gave her general anæsthesia, whereupon the bleeding became twice as much in quantity. That was a concrete example of how much bleeding is saved by local anæsthesia.

CARCINOMA OF THE BREAST: BILATERAL RECURRENCE IN THE NECK

Dr. James H. Kenyon presented a woman, forty-three years of age, who was admitted to the hospital January 6, 1920, with a small lump in her left breast, noticed about two years before. She thought it had varied in size from time to time, but had never been painful. Examination showed a hard nodular tumor about one inch in diameter, just above and to the inner side of the left nipple. It was moveable on the deeper parts, but the skin over it was adherent. The next day the left breast, both pectorals, axillary contents, glands and fat fascia were removed. The Jabez Jackson incision was employed. The axillary nodes appeared to be normal and no dissection was made above the clavicle. The margins of the wound were undermined and were readily sutured. A cigarette drain was placed through a small stab wound in the axilla. The patient made an excellent recovery, left the hospital on the fourteenth day. She gained weight, had perfect motion of the arm, and never felt better in her life until the latter part of November, 1923, when she thought she had taken cold; her voice became hoarse, and during the next month there was some shortness of breath, a tendency to choke at times, and some general fulness of the neck.

Examination shows the old scar and axilla free from any involvement, other breast and axilla normal, but there is a general fulness of the neck and on both sides the nodes, superficial and deep, are much enlarged, hard, but not tender. At this present time, February 13th, she can only speak in a whisper. Examination of the larynx shows sluggish movements of the arytenoids and vocal cords, otherwise normal. She has been getting X-ray treatment.

CONTRACTURE OF AXILLARY BURN CICATRIX

DR. CARL G. BURDICK presented a child, nine years old, with a web contraction of the right axilla following a third degree burn of chest and right axilla occurring in 1919. Admitted to the Children's Surgical Service of Bellevue Hospital in October, 1920, with a contracture of both anterior and posterior folds of the right axilla limiting abduction to about 45 degrees. There was a pocket of normal skin in the apex of the axilla and for this reason an attempt was made to slide a flap from the chest wall reconstructing the anterior fold, the reconstruction of the posterior fold being left for a later date.

One year later the deformity had recurred and in February, 1922, she was readmitted to Bellevue Hospital. The method employed at this time was one suggested by Doctor Abbe. This consisted in piercing and tunnelling the web at a point opposite the apex of the axilla on the normal side. A tubed pedicle flap with the epithelium on the inside was taken from the scapular region and brought through the tunnel, the end being sutured to the anterior incisions in the web and a wick of vaselinated gauze drawn through the tube. Two weeks later the base of the pedicle was cut across and sutured to the margins of the incisions in the posterior web.

The child developed a specific vaginitis and for this reason was not readmitted again to the surgical wards until November, 1922. Operation. A grooved director was passed through the tube and the web and tube divided care being taken to meet the incision in the web enough external so that there would be sufficient flap to entirely form the inner wall of the axilla. The arm could now be fully abducted and the skin flap was sutured to the inner margin of the opened tube graft without tension. A denuded triangular area about 5 cm. on each side was left on the inner side of the arm. A full thickness non-pedicle flap was sutured into this defect, resulting in about a two-thirds take. Care must be taken in dividing the web that none of the nerves from the brachial plexis lie external to the tube. This method is applicable to all cases where a tube can be obtained from either the anterior or posterior chest wall

Davis, in a recent article on this subject, reports a series of 48 cases and describes several methods, but does not mention this particular one. Two are similar, the first consisting of perforating the web and inserting a glass tube allowing the sinus to epithelize. In the second, he takes one flap from one surface of the web with the pedicle above, the other flap from the other surface of the web with the pedicle below and forms a fistula by suturing the flaps together. This has the disadvantage of taking the flap from the web, which might better be utilized later in covering the denuded areas on the walls of the axilla.

DR. GEORGE H. SEMKEN believed that in cases of chicken-wing deformity, a recurrence of the deformity is probable if a vertical scar remains in the axilla. To obviate this, a flap is swung across the dissected space from either the anterior or the posterior wound border, preferably the posterior; and the wound left at the site of this flap is covered with a Thiersch graft. The resultant axillary scar is a parabola laid upon its side; and the intervening skin can be freely stretched through the arm movements, after healing has been completed, without danger of contraction.

The plan of operation adopted in correcting the deformity of the lip is

very ingenious. The problem is difficult when the premaxilla has been removed, as had been done in this case, but Doctor Burdick seems also to have largely overcome the external deformity caused by this earlier procedure.

HARE-LIP

Dr. Carl G. Burdick presented a man, aged twenty-nine, who had been operated on in infancy for a double hare-lip. The premaxillary bone had been excised at that time and he was left with the deformity which frequently follows these operations, of a recession and contraction of the upper lip, and a redundancy of the lower lip. The best method of improving this condition is by an operation described by Brophy, but originally performed by Abbe. This consists in first making an incision in the upper lip through its thickness in the median line. This leaves a V-shaped deficiency which is filled by a similar shaped pedicle flap turned up from the lower lip as follows: An incision is made to the left of the centre downwards and inwards to the median line, the length of this incision corresponding to the length of the incision in the upper lip. A vertical incision upwards completes the V, but care must be taken not to carry this so far as to damage the blood supply to the flap. It is easy to estimate the location of the artery from its situation on the other side of the lip. The flap is now turned upwards and to the right and sutured into the deficiency in the upper lip, care being taken to approximate the vermillion borders. A suture is now placed through the two lips on the right side to prevent their separation. The freshened surfaces of the lower lip are now sutured and a Barton bandage applied.

Feeding is accomplished through a tube which can be inserted at the left angle of the mouth.

Ten days to two weeks later the pedicle is divided and swung over to the left and the vermillion border on this side accurately approximated. The operation is completed by freshing and approximating the wounds in the lower lip. If the mouth is too small it can easily be enlarged to the desired size by making an incision at either angle and approximating the skin and mucous membrane.

In the case presented when the pedicle of the flap was divided a second but smaller V was made in the lower lip. An incision was made starting at the original incision in the upper lip just above the vermillion border and carried upwards and outwards, a distance equal to the length of the V. All raw surfaces were freshened and the triangular flap was inserted into this deficiency, which gave considerable added tissue to the upper lip and further decreased the redundancy of the lower lip. The operation was concluded by accurately approximating the vermillion borders of both lips.

TRAUMATIC FAT NECROSIS OF THE FEMALE BREAST

Dr. Burton J. Lee read a paper with the above title.

Dr. Frank E. Adair (by invitation) said that traumatic fat necrosis is a disease of the fat tissue and *not* of the mammary tissue. Practically speaking, it is a disease that occurs in lipomatosis of the breast. Two years ago before the Surgical Section, when discussing the speaker's paper on this disease, Dr. Seward Erdman brought up the question, "Why do we not encounter the same condition following a trauma of a very fat abdominal

wall?" The answer would probably be that the abdominal wall has no bony background as does the breast. There is a "give" to the abdominal wall; but the breast receives the full effects of the blow because the chest wall is not elastic.

In acute pancreatitis there is acute necrosis produced in the fat tissue of the omentum which is associated with polymorphonuclear infiltration and the formation of giant cells. In traumatic fat necrosis there is necrosis associated with mononuclear and the formation of giant cells. The pancreatic injury with its tissue reaction is probably a comparable process which occurs in the breast, the former being a very violent tissue reaction while the latter is a slower process.

For the first two or three years following injury the clinical picture of this disease is definitely that of carcinoma. The speaker's cases of eight and ten years following injury presented the appearance of benign tumors.

Dr. Hugh Auchincloss thought Doctor Lee's description of fat necroses was valuable because of the necessity for having to consider them in the list of clinically doubtful lesions of the breast. He cited the case of Thayer, who in 1906 reported calcification following introduction of calcium in the mammary region for typhoid hemorrhage. He showed slides of two cases he had studied several years ago, operated on by other surgeons. Both show degeneration areas resembling cystic cavities, one with hemorrhage. The walls of this were made up of innumerable phagocytic cells and giant cells about cholesterol crystal spaces, and containing blood pigment. The wall of the other was made up of granulation tissue containing places where clusters of giant cells enclosed fatty acid crystals. The first was definitely the result of trauma. The second resembled tuberculosis but probably was not.

One thing in common with all these areas of necrosis with carcinoma is the evidence of signs of retraction. He showed slides bearing on the pathogenesis of retraction signs.

Dr. Willy Meyer said that he considered that Doctor Lee had added a clinical entity to diseases of the breast. It was clear that the etiology always was traumatism, although in four of the cases mentioned this could not be proven. That made it doubly difficult to differentiate this condition from carcinoma which is often the result of traumatism. It was to be hoped that the originator who established the disease would succeed in learning to make a positive differential diagnosis. For the present it would be wiser in cases of doubt to do a radical operation than to do a local excision. If the pathologist finds the growth is benign, then the patient can be congratulated on its not being carcinoma. The speaker had had opportunity to observe one case of this type lately following extirpation of the breast for cancer of a supernumerary axillary breast. Three small nodules which appeared five months after the radical operation were considered to be due to early recurrence. The pathologist reported fat necroses for all three.

DOCTOR LEE, in closing the discussion, said that the cases which showed the calcareous deposits were the old cases which have existed for eight or ten years, and these are the ones that are easiest to diagnose. In those which have shown symptoms for a much shorter time, where skin retraction and axillary nodes are present, the diagnosis is much more difficult, as many of the features ordinarily associated with malignant disease are present.

Stated Meeting Held February 27, 1924

The President, DR. EUGENE H. POOL, in the Chair

LATE RESULTS OF FRACTURES IN CHILDREN

DR. KIRBY DWIGHT presented a boy who at the age of eight, two and a half years ago fell from a height of three feet and sustained a fracture of the external condyle of the left humerus. The displacement was considerable and after three unsuccessful attempts to reduce it, the boy was admitted to the hospital for operation. Doctor Dowd operated and removed the fragment, as it was free and had no blood supply. Now there is flexion to 30°, extension to 160°, pronation 90° and supination 90°. There is apparently about a 5° increase in the carrying angle. Practically the function of the arm is complete.

DOCTOR DWIGHT then presented a little girl, who about a year and a half ago when she was seven years old, fell a distance of twenty feet and sustained a fracture of the surgical neck of the left humerus. She was treated by suspension and traction with the arm abducted, but reduction of the displacement was incomplete. There was considerable angular displacement. Now the motions at the shoulder-joint are perfect and the X-ray shows a perfectly normal upper extremity of the humerus.

DOCTOR DWIGHT also presented a girl, who about four years ago, when she was ten years old, fell while roller skating and broke both bones of her right forearm, about two inches above the wrist. There were overriding and angular displacement of both the bones, which could not be reduced. Open reduction was considered and decided against. Now there is no deformity, function is perfect, pronation 70°, supination 90° (on the left side pronation is 85°, supination 90°). The X-rays show hardly a trace of the injury.

DOCTOR DWIGHT presented a lad who two and a half years ago, at the age of fifteen, while flying a kite from the roof of his house, ran off the edge of the roof and fell five stories. He was brought to Roosevelt Hospital with a compound fracture of the right femur, lower third, and simple fracture of the left femur, lower third. Immediate operation was done, with débridement, open reduction and primary closure of the compound fracture. On account of the great shock the boy was in, nothing was done to the other femur at this time. But on the second day following closed reduction

was done on the left femur and it was put up in a plaster spica. Suspension and traction (skin traction) was used for the right femur.

Meantime the boy's temperature was very high, about 105°: This was thought to be due to a reaction from the tetanus antitoxin, a double dose of which had been given him inadvertently. Up to the fourth day the wound was clean, no redness or other sign of infection, but on the fourth day some pus was seen to ooze out from between the sutures. The wound was opened widely and a large quantity of foul, colon smelling pus was evacuated. Culture showed B. Coli. Carrel-Dakin treatment was started.

On the sixteenth day the boy was running a high temperature. A bedsore was found on the left buttock and the plaster spica was removed and suspension and skin traction applied to the left thigh.

By the thirtieth day the patient was in very poor condition; looked septic; Temperature 104° each day; right thigh in dreadful condition. Amputation advised, but refused by boy's parents.

On the thirty-seventh day was transfused. Very little hope for his life.

Ninth week; signs of abscess at site of fracture in *left* thigh; it was opened and a large quantity of colon bacillus pus was evacuated. This was evidently a hæmatogenous infection of the simple fracture of the left femur. There were no further hæmatogenous abscesses. Blood culture not taken.

Tenth week; boy in bad shape; temperature to 104° each day; all effort to keep fragments in position have had to be abandoned, on right side upper fragment protrudes through wound and is apparently dead for several inches; on left side the upper end of the lower fragment has pierced the skin posteriorly just above the popliteal space. Suspension with a little traction kept up to facilitate dressings. Seems like a painful and useless prolongation of life.

Sixteenth week; boy is better; temperature to about 100° each day; Traction removed from both legs; mesial splints applied.

Seventeenth week; steady improvement in general condition.

Twentieth week; union beginning, both legs.

Twenty-fourth week; union firm.

Twenty-seventh week; walking on crutches. X-ray at this time shows how union may take place sometimes under the most unfavorable conditions. Not only were the fragments bathed in pus but they were not even in contact, a space of about an inch on both sides having been bridged by the callus.

Union had taken place with the fragments in very poor position, but there *was* union and the boy's life had been spared. There was shortening (estimated) on the right side of four and a h lf inches; on the left side of four inches.

Today this boy is strong and healthy. He can play and run and jump almost like the other boys. His right leg is a half inch shorter than his left. His thighs are markedly deformed, but when dressed this deformity does not show.

FOREIGN BODY IN DUODENUM OF CHILD

Dr. Charles N. Dowd said that for several years he had called attention to the power of repairing fractured bones which is shown in children. He remembered showing a case before this Society in March, 1915, in which marked displacement remained after two efforts to reduce the fracture of both bones of the forearm under anæsthesia and where a picture taken a year later showed practically no deformity. In the intervening period he had seen many cases and had pictures illustrating the good results which had been obtained without operation. There was a notable case, a little more than a year ago, in which a ten year old child of a friend had fractured both bones of the forearm about two inches above the wrist. Three efforts had been made to reduce the deformity under anæsthesia, but they were unsuccessful and marked deformity existed, with the upper fragment of the radius apparently touching the ulna. In order to learn the general feeling as to the proper treatment of these cases, he had shown the X-rays to a number of surgeons and could find no one who advised against operation. In spite of this the forearm was simply left in splints and repeated X-ray photos were taken to watch the repair of the bone. After a few months the repair was apparently perfect and the function perfect, thus giving another example of children's power to repair bone fractures.

It is manifestly unwise to operate on such cases. The speaker had thought much of this problem and had urged Doctor Dwight to take it up and was much pleased to know that he had a large group of cases which illustrated this topic. He had followed many of the cases personally and had verified the good results which Doctor Dwight had obtained.

Dr. Edward D. Truesdell presented an X-ray of the pelvis and thighs of a child who had had a fracture of the shaft of the femur one year ago. The injured bone was shown to be an inch longer than the bone of the opposite side, due to overgrowth subsequent to the termination of treatment. Fear of permanent shortening is very rarely, if ever, an indication for operation in fractures of the femur in children, as the shortening ordinarily existing at the termination of treatment is uniformly compensated for by a period of accelerated growth, as was shown in the röntgenogram presented and by the investigation of a series of these cases in the follow-up. Doctor Truesdell said that he had removed the fragment in three cases of fracture of the external condyle in children, with results similar to Doctor Dwight's. There was slight increase in the carrying angle, some prominence of the head of the radius, but the elbows were strong and with normal function. He believed this procedure to be indicated in those cases where replacement of the fragment could not be accomplished.

FOREIGN BODY IN DUODENUM OF CHILD

Dr. Edward D. Truesdell presented a boy, aged fifteen, who on July 3, 1921, accidently swallowed his scarf pin which he was attempting to straighten with the aid of his teeth. He repaired to a neighboring drug store where he was given an ounce of castor oil which he promptly vomited, but

did not vomit the pin. He applied at St. Luke's Hospital the same day and an X-ray examination determined the presence of the pin in the upper part of his abdomen, probably in the stomach. Repeated X-rays during the next five weeks indicated little change in the position of the foreign body, which, with the aid of bismuth meals, Doctor Le Wald believed to be arrested in the terminal duodenum. August 9, 1921 the abdomen was opened and the pin readily located in the terminal portion of the duodenum, the head, or blunt end, upward. At a location opposite the point of the pin there was firm inflammatory adhesion between that portion of the duodenum and the adjacent jejunum. As this was too firm to yield readily to attempts at separation, an incision was made over the head of the pin this extracted, and the incision in the duodenum and abdominal wall closed. Recovery was uneventful.

Several years ago the speaker removed an open safety-pin from the duodenum of a child. This had been swallowed several weeks before. The point had penetrated the posterior wall of the duodenum and had caused a retroperitoneal infection. This case shown is interesting because of the size of the object swallowed, because of the arrest of this in the duodenum, and the evident process of stoma formation between duodenum and jejunum, which would soon have released the pin and permitted the continuation of its trip through the intestines. The speaker believed that sharp-pointed objects becoming fixed at some point in the intestinal canal should be promptly removed, before stoma formation or perforation with infection occurred, particularly when of considerable size and definitely located.

DUODENAL OBSTRUCTION FROM TRANSMESENTERIC HERNIA IN AN INFANT

Doctor Truesdell presented a child, ten months of age, born April 7, 1923 at term, a second child, normal delivery, weight 7¾ pounds. When two days old the patient began to vomit and continued to do so. When two weeks old he was transferred to the Pediatric Division of Nursery and Child's Hospital because of persistent vomiting and rapid loss of weight. On examination the baby was found to be emaciated and considerably prostrated. There was no abdominal tumor, no distention, no peristaltic waves. Exploratory laparotomy seemed indicated on account of (1) Persistent vomiting, sometimes projectile, sometimes containing bile, and not controlled by modifications of formulæ. (2) Scant stools. (3) Gastric retention, 80 per cent. of test meal after 2½ hours. (4) Bismuth meal X-ray showing retention in stomach and duodenum. (5) Rapid loss of weight (1½ pounds) and strength.

The pre-operative diagnosis was partial intestinal obstruction, probably due to congenital deformity of intestine.

On April 24, when patient was seventeen days old, the abdomen was opened. The stomach was not dilated. There was no pyloric tumor.

The duodenum was found dilated because of compression of its terminal portion in passing through an aperture in the upper part of the root of the mesentery from right to left side.

The operative procedure consisted in division of the anterior margin of the aperture which was sharply defined and rigid. No other lesion was found. The abdomen was closed.

There was immediate decrease in the tendency to vomit, and the stools became ample. There was no gain in weight for one month, thought to be due to difficulty in adjustment to formula. At three months weight was 7 pounds; at six months 10½ pounds; nine months 13½ pounds; now 14¾ pounds.

This case was presented as an instance of infantile vomiting due to an abnormality of the intestine, which might readily be mistaken for a feeding case. To exclude a hypertrophic pyloric stenosis or a complete obstruction does not justify the assumption that persistent vomiting in infancy is a matter of feeding in all cases. There are occasional cases, usually vague but urgent, that lend themselves to surgical treatment.

ULCER OF DUODENUM, THIRD PORTION

DR. CARL EGGERS presented a man, thirty years of age who was admitted to the Medical Service of the Lenox Hill Hospital on August 8, 1923. His chief complaint was pain in the right hypochondrium, radiating to the umbilical region, immediately following the ingestion of food, and accompanied by belching of gas. Duration five weeks.

The patient had been well until about six weeks ago when he first noticed burning pain in the epigastrium, which came on 1½ to 2 hours after meals, was not relieved by food, and did not occur during night. About five weeks ago this pain subsided and a different pain developed, situated in the right hypochondrium beneath the costal arch. This pain came on immediately after meals, radiated to the umbilical region and was accompanied by belching of gas. Food did not relieve it. It usually lasted about three hours. There was some radiation to the back, but none to the shoulders. His appetite had been good until two weeks ago, but since then he had been afraid to eat. He frequently vomited after eating, but he had never noticed blood. He had lost 15 pounds in weight since onset. There had been no jaundice. He was usually very constipated, requiring a laxative daily. There was nothing in his habits or family history of interest in relation to his complaint. On physical examination the only findings were: Tenderness over the region of the appendix, over the right iliac crest, and over the left epigastrium. There was no rigidity, and no abnormal masses could be felt. The spleen was enlarged. From the history a gastric or duodenal ulcer was suspected and efforts were made to substantiate this diagnosis. A test meal showed no retention. Free acid 56, total acidity 78. No blood-pressure. The X-ray examination did not reveal any defects in contour of the stomach or the cap. The stomach emptied

normally, within the six-hour period. The cæcal region showed deformities suggestive of chronic appendicitis. On the basis of these findings the diagnosis of chronic appendicitis with reflex stomach symptoms was made, and the patient referred to the surgical service.

On August 18, 1923, an incision for exposure of the appendix was made. The latter was small and atrophic and evidently not the cause of the symptoms. It was removed and the stump buried. Further exploration revealed a hard nodular tumor in the right upper abdomen, which seemed to be situated retroperitoneally. It impressed as a mass of glands, and was about the size of a walnut. In order to expose it the incision was enlarged upward. The tumor was found to be retroperitoneal, palpable through the parietal peritoneum and the transverse mesocolon. The former was incised, exposing a pinkish tumor, the anterior surface of which was smooth. Through it, however, a nodular mass could be palpated. From its position it was suspected to be duodenum. In order to make sure an incision was made by which it was found that the lumen of the gut had been opened into. The palpating finger could be passed to the left without interruption, but in the upward direction it was blocked by a hard ulcerating tumor which partly obstructed the lumen. The incision was closed with two rows of fine chromic catgut and the parietal peritoneum then sutured over it. A gastro-enterostomy was decided on. The stomach could not be reached through the existing incision. This was therefore closed and an epigastric incision made. The stomach was found to be normal. The entire anterior surface of the liver was adherent to the abdominal wall. The duodenum which could be reached from above, was normal. A posterior short loop gastro-enterostomy was done, using silk for the inner and outer suture. The abdomen was closed in layers.

The convalescence was uneventful. Immediately after the operation the patient felt relieved, and he has had no pain since. The incision in the duodenum produced no untoward results. At no time were there signs of leakage. Subsequent X-ray pictures showed the stomach entirely empty after three and one-half hours, all food passing through the gastro-enterostomy. The patient was discharged September 16, 1923.

CHRONIC PERFORATING ULCER OF DUODENUM

Dr. John A. Hartwell presented three patients, two males and one female, all of whom had suffered from a nearly identical lesion, a large, chronically perforating ulcer of the duodenum extending well down toward its second portion. In every case the ulcer itself was practically destroyed by the perforating process so that on removal of the pylorus and the first portion of the duodenum, only the perforation surrounded in part by inflammatory thickening remained to show the site of the lesion. The perforation was protected by inflammatory exudate in the outer coat and adhesion to the gastrohepatic omentum, the pancreas, or the gall-bladder, it being impossible to determine exactly what structure was the most protective.

The history was almost identical in all the cases. The ages were thirty-one, thirty-five and thirty-seven years respectively and in each case symptoms typical of duodenal ulcer had been present for five years with increasing severity. In all, the pain had become practically constant during a period of six months and the relief from food and alkalies had become less marked. All had been under more or less dietetic treatment with marked improvement but recurrence later. Vomiting had been a very marked symptom in two of the cases but not in the third. One of the men had vomited blood and passed it with feces in sufficient amount to produce a severe grade of anemia. The other two had been without bleeding which could be clinically diagnosed. An important and distinctive symptom that is infrequently present when the ulcer is not perforating was very marked in all these patients, namely a definite, marked tenderness on pressure in the epigastrium just to the right of the spinal column. This corresponded exactly to the site of the impaired peritoneum over the ulcer.

The diagnosis was confirmed in every case by the fluoroscopic findings at the Cornell Clinic as a "filling defect with fixation of the first portion of the duodenum." In cases so evident as these we do not deem it necessary to take films except for purposes of teaching or additional record. The Gastro-enterological Department at Cornell has made a larger per cent. of correct findings by the fluoroscope alone than by films alone. The latter are only used when the clinical diagnosis and the fluoroscopic diagnosis are not in accord.

In all of these cases a resection was done from the pyloric antrum to the second portion of the duodenum. In all, great difficulty was experienced in closing the duodenal stump because the ulcer had encroached so closely to the papilla that satisfactory inversion was not practicable. They were therefore closed by a through-and-through suture of chromic catgut and one or two layers of peritoneal sutures reinforced by burying against the pancreas or covering by omentum, as seemed more efficient. The reëstablishment of the alimentary lumen varied in the three cases.

In one man, the least involved, a typical Billroth II was performed, while in the other two the jejunum was anastomosed to the proximal end of the stomach according to Polya. In the woman, the more proximal portion of the jejunal stoma was at the greater curvature of the gastric stoma, while in the third case it was at the lesser curvature; there was thus a complete reversal of the jejunum in the third case but not in the second. In the latter, post-operative vomiting was a very marked symptom and great care in diet with lavage was needed for three or four weeks to overcome this. Such did not occur in the other cases. This is somewhat comparable with experience in posterior gastro-enterostomy though at the present time most surgeons lay the jejunum against the stomach in this operation, depending on the natural fall of the loop to obtain the most satisfactory emptying of the stomach.

The selection in these two cases was made upon this principle, but a

further study shows that simple posterior gastro-enterostomy is not exactly comparable to the Polya type in this particular. The open end of the stomach when drawn through the incision in the transverse mesocolon looks downward and to the right, the greater curvature being dependent and fairly movable, while the lesser curvature is obliquely above it and comparatively fixed. Thus, with the proximal end of the jejunal lumen at the gastric curvature the stomach contents being propelled along the more active greater curvature is prone to enter the jejunum against the current and dam up there. Again, the jejunal content has a more direct route into the stomach when the antiperistalsis of the stomach is active during digestion. These factors do not hold when the proximal end of the jejunal stoma is at the lesser curvature, and this therefore seems the method of choice. In the most advanced case, the man who had had severe bleeding, the closure of the duodenal stump proved imperfect and leakage took place and lasted for ten days. To our surprise, this closed spontaneously and, except for the breaking down of the wound, no ill effects resulted.

Certain technical points are employed in all these cases as a routine. The abdominal incision is always made vertically through the middle of the anterior rectus sheath and the inner leaf of this sheath lifted up to the midline. The entire rectus is dislocated outward and the posterior sheath together with the peritoneum incised near the midline where the structures are strong. These two are clamped together during the operation and later sutured as one layer at the close of the operation, the rectus being restored to its normal position and the anterior sheath sutured with care. When drainage is needed, as in gall-bladder cases, or acute gastric or duodenal perforation, it is done through a stab wound in the side entering Morrison's pouch. Our experience makes us believe that hernia is less frequent by this method than by others. The actual anastomoses are made without the use of clamps, the field being protected with gauze pads. All unions are made with careful suturing of the mucosa, the submucosa and the peritoneal and muscular coats. Actual hæmostasis is obtained by clamping and ligating and there is no inverting stitch used, except on the outer layer which we are careful not to have penetrate the submucosa.

Section of the stomach and bowel is always made with the knife and the edges are always touched with carbolic acid and alcohol. These procedures give excellent coaptation of the various layers of the stomach and bowel, make post-operative bleeding impossible and, on the final healing of the anastomoses, leave a freely moving mucosa over the other structure of the wall.

A specimen removed at autopsy in a case of œsophageal pharyngeal cancer where a gastrostomy was done illustrates this point. One portion of the trap door in the Janeway operation was sutured by a "loop on mucosa" stitch while another part was sutured by the method here described. The contrast is marked, the latter showing a nicely united mucosal tissue moving over the underlying coats while the former showed much more scar tissue and greater fixation of the mucosa. An additional safeguard

against production of ulcer similar to the marginal type in gastro-jejunostomy is furnished by this layer to layer method of suture.

DUODENAL ULCER. RESECTION OF DUODENUM AND ANTRUM OF THE STOMACH

DR. HERMANN FISCHER presented a man who had suffered from stomach trouble for fourteen years. Three years ago was operated upon in another hospital for an epigastric hernia. After this operation he felt a little better, but soon his cramp-like pain in the epigastrium returned in intervals of two weeks. This condition continued until September, 1923, when he vomited for the first time and his pain became almost continuous and very severe.

Findings at operation: Ulcer on the antero-superior surface of the duodenum near the pylorus. Dense adhesions along the duodenum running to the hepato-duodenal ligament as well as fine adhesions between the pancreas and the posterior wall of the duodenum. The duodenal wall surrounding the ulcer is infiltrated and œdematous. After the duodenum had been thoroughly freed from all adhesions, it appeared so well mobilized that a resection of the duodenum with pylorus and antrum of the stomach was feasable. This was done and 11 cm. of the lesser curvature and 15 cm. of the greater curvature of the stomach were removed together with the ulcer bearing area of the duodenum. As the remaining stump of the duodenum showed some infiltration, the original plan of doing a Billroth I operation was abandoned and a Billroth II after Balfour-Polya was done. Insertion of Einhorn duodenal tube for immediate feeding. Uneventful recovery.

RESECTION OF STOMACH FOR ULCER

DOCTOR FISCHER presented a man who fourteen months ago began to have pain of a sharp and burning character in the epigastrium which occurred about one hour after meals. He was treated in a hospital in Austria for some weeks and left from there somewhat improved. He felt fairly well until ten weeks ago when his distress came back in its old intensity. He lost about fifteen pounds in weight. He vomits occasionally but never noticed blood in his vomitus. Bowels are constipated, no blood in stool, as far as he knows. Physical examination negative, except for pain and tenderness in epigastrium. X-ray reveals a large penetrating ulcer at the lesser curvature. Inflammatory adhesions are involving the pyloric end of the stomach to such an extent that they interfere with the normal emptying power.

Operation November 3, 1921, splanchnic anæsthesia. A large penetrating ulcer of the lesser curvature of the stomach was found. It has penetrated posteriorly and adherent to the pancreas. Resection of about one-half of stomach after Polya-Balfour. Patient left table in good condition and made an uneventful recovery.

DOCTOR FISCHER presented also a woman who on account of stomach

trouble lasting for several months, with loss of twenty pounds in weight, was subjected to operation December 30, 1922. On opening of abdomen very extensive adhesions were found, running from the free border of the liver to the stomach and from there on to the anterior abdominal wall. The adhesions were so dense and extensive that the whole anterior surface of the stomach and the gall-bladder were buried by them. After freeing the organs from this mass of adhesions it was found that they had to deal with a large hour-glass stomach, caused by the penetrating ulcer, situated half-way between the pylorus and the cardia, the two sacs being of almost equal size. Resection of almost two-thirds of the stomach with antrum and pylorus was done, by Billroth I method. Einhorn tube feeding. Uneventful recovery.

Doctor Fischer finally presented a man who, after having suffered from stomach trouble for twenty years, and having been treated for a long time and repeatedly medically without benefit, was operated upon by him. On opening of abdomen indurated mass of the size of a plum was found at the lesser curvature about two inches away from the pylorus. Impossible to decide whether carcinoma or indurated ulcer. Glands enlarged along lesser and greater curvature. Resection of pylorus and about half of stomach. Billroth I. Einhorn tube feeding. Uneventful recovery.

CHRONIC DUODENAL AND GASTRIC ULCER; PRESENT STATUS OF SURGICAL TREATMENT

Dr. Charles H. Peck read a paper with the above title for which see Annals of Surgery for July, 1924.

Doctor Peck presented seven patients to illustrate his paper.

Dr. Charles N. Dowd said that the group of cases which give the most satisfactory results in stomach surgery are of course, those who have pyloric stenosis. The recovery is marvelous and there is usually freedom from complications. These cases, however, are not now seen in as great proportion as they used to be. They used to represent about 20 per cent. of his own surgical stomach cases but the proportion is now less because the conditions which produced stenosis are now treated at an earlier period and cicatricial contracture does not follow.

The most pressing question at the present time is the treatment of ulcers in or near the duodenum, since they are far more common than those in the stomach itself. Personally the speaker's experience has been like Doctor Peck's, that cases of duodenal ulcer treated by gastro-enterostomy do well. They show marked improvement and enjoy reasonably good health. It seems fair to believe that the diminished acidity of the stomach contents and the change in the mode of its exit from the stomach may easily account for this improvement. Next to the operation for pyloric stenosis and the operation for perforated ulcer, the gastro-enterostomy for duodenal ulcer seems to form the most satisfactory group of stomach operations

When the ulcer extends so as to be both on the duodenal and stomach

sides of the pylorus, one meets one of the most puzzling problems which we have. The question of pylorectomy then arises. One does not wish to do a pylorectomy on a case which will be cured by a gastro-enterostomy nor does one wish to omit a pylorectomy on a case which may really be malignant. The amount of induration which exists about a simple ulcer in this locality is often so great that it really feels like malignancy. He had several times had the experience of doing a primary gastro-enterostomy in the expectation of doing a later pylorectomy, being confident that the pylorectomy would be much easier after the inflammatory induration had subsided, and at the second operation found that no evidence of induration remained. It is surely safe to omit a pylorectomy on a very large proportion of these patients.

Dr. John Douglas said that he was in complete accord with each and every one of the conclusions of Doctor Peck's timely and most excellent paper, and as he could not criticize any of his conclusions, he could only perhaps try to add to his argument.

It was his belief that the results of gastro-enterostomy with excision of the ulcer when feasible, if the operation is properly indicated and correctly performed and the patient given suitable after care, gives better results than generally accepted. It must be acknowledged at the start that gastro-enterostomy is not an ideal operation, even if associated with removal of the ulcer by cautery or excision, as it does not attack directly the etiological factors influencing ulcer formation. But no one knows the exact cause of the chronic indurated ulcer of the stomach or duodenum, or why it recurs, and even the experimental work of Mann and others of sidetracking the duodenal alkali flow, and the work of Roseneau and his followers along the line of specific streptococcus infection, has not cleared everything up so as to make obvious the ideal operation. The fact must be accepted that certain complications occur and various conditions cause a certain percentage of poor after results, two to three or even some say five per cent. of jejunal ulcer, two per cent. of hemorrhage, occasionally a gastrocolic fistula, very rarely a perforation, and that there are a certain number of cases who still complain of gastric symptoms after their operation. It is these patients who return many many times with their difficult problems, while the cured cases are lost sight of.

It is a bit difficult to reconcile the difference in the reports of the results of gastro-enterostomy in the American and some of the European clinics. Mayo states 90 per cent. of satisfactory results were obtained in duodenal ulcer cases without excision. Ninety-five per cent. were cured surgically but more than one operation was necessary. Finny, 77 per cent. cured by gastro-enterostomy and 88 per cent. by pyloroplasty; Pool, 84 per cent.; Deaver 80 per cent. well and 10 per cent. markedly improved; Scudder 93 per cent.; Peck 80 to 90 per cent. In contrast to these figures, Finsterer in a recent lecture given in New York, quotes Payr as having 62 per cent. recov-

eries and 37 per cent. failures; Bier 66 per cent. recoveries and Harberer 37 per cent. of recoveries.

If these latter figures are correctly quoted, it is but natural that there should be dissatisfaction with the results and different methods attempted and this led to the radical operation of resection of the pylorus and antral portions of the stomach by Harberer, Lorenz, Schur, and others on the theory of removing that portion of the stomach which secreted a hormone that activated the acid-producing glands of the fundas.

One cannot deny that except in the hands of the surgeon most qualified by experience in gastric surgery, such procedure must have a higher mortality than simple excision or gastro-enterostomy or both, and to justify it either the theory on which it is founded must be proved correct or the results obtained must be manifestly superior. As to the theory, Smithies insists that ulcer occurs without hyperacidity and all surgeons have seen many such cases. As to the results, to quote Finsterer again: He states that ulcer in the duodenum or at the anastomosis "were already observed in 29 cases" and Harberer himself has reported three cases after antral resection; and Cole and Hoguet have reported a large marginal ulcer surrounding the stoma following a Polya resection. For this reason, Finsterer advocated resection of more than two-thirds of the stomach, with the portion of the duodenum containing the ulcer, or if the duodenum cannot be removed, the resection of the stomach leaving the ulcer. This he calls the atypical operation. He reports 94 per cent. of cures and a surprisingly low mortality—372 cases of (gastric and duodenal) resection for duodenal ulcer with 3.6 per cent. mortality, but he has had a large experience stating that he has done more than 700 resections in the past twelve years and does practically all of his work with local and regional anæsthesia.

Since June, 1918, there have been at St. Luke's Hospital 123 operations for duodenal ulcer. The follow-up record on these cases has been as carefully kept as possible. Doctor Douglas said he was not prepared to give the statistics in detail, but of 95 cases followed for from six months to five years, 81 are reported as cured or 86 per cent. and nine or 9.5 reported improved. Only five or 4.5 per cent. are reported as unimproved. Of the uncomplicated cases, excluding 22 cases of perforated ulcer; one case of obstructive jaundice and one of pernicious in which the ulcers were complications and not primary lesions, there were four deaths in 108 cases or 3.7 per cent.

Seeing many of these cases personally and talking with the other members of the staff who have examined the patients, the speaker believed that good results can be obtained with the use of gastro-enterostomy with excision when possible, or with pyloroplasty. That a correctly and carefully performed operation, and a properly sized and placed stoma is essential, and that after care both in respect to diet, alkalies, intestinal hygiene and removal of possible foci of infection, will further improve the results so that the radical operations of partial gastrectomy for duodenal ulcer will not be necessary or advisable.

Dr. Walter A. Bastedo (by invitation) said that there were some cases that were obviously medical and some that were obviously surgical. It was just as wrong for a medical man to treat a surgical case as it was for a surgeon to operate on every case that came to him just because it was ulcer. On the other hand, there is a middle class of cases in which one might be in doubt in the choice of medical or surgical treatment. If these cases, however, are not curable by medical means, this can be readily proven by trial. Undoubtedly medical men do have a little prejudice against surgery because so many post-operative cases come to them with distress and trouble, especially after gastro-enterostomy. Such he believes to be fewer now than previously, owing to the great improvement in surgery. It is obvious that duodenal ulcer cases are in a class entirely different from stomach cases. The latter are more serious. All duodenal cases are not serious; there are always the menaces of extension, hemorrhage and perforation, but many of these ulcers are carried for years without anything serious happening. But that is not often the case in stomach ulcer and here there is the added menace there of carcinoma developing. Not long ago a surgeon said that medical treatment does not obviate the possibility of cancerous development. But medical treatment, if it cures the ulcer, is just as successful in preventing cancer in that area as surgical treatment. Besides, it is known that many cases have developed cancer after surgery and many supposed ulcers have turned out to be cancer when examined by the pathologist. Most of the surgeons are pessimistic when there is cancer there, for even these supposed ulcer, though really cancer cases, generally die ultimately of cancer, no matter what operation is done. Doctor Bastedo favors the excision of the ulcer when this is possible, for this is the only hope from a cancer point of view. There was one condition in which medical treatment had the advantage over surgical: the diagnosis of ulcer was sometimes made when there is no ulcer, and in such case surely it is better for the patient to have a medical cure than to be opened up and have the surgeon discover that no ulcer is present. He asked the surgeons how often such an event happens. Another thing of very great interest is that sometimes after a perfectly good gastro-enterostomy and in the presence of a well-working stoma, new ulcers develop, not marginal or jejunal, but in the body of the stomach or the duodenum; in other words, the procedure which was done for the express purpose of putting the stomach in a condition favorable to the cure of ulcer permits the development of new ulcers. Yet, as a rule, gastro-enterostomy is successful in the cure of ulcer, and is an operation that he would not wish abolished.

Dr. John F. Erdmann called attention to the operation of Horsley, as the most satisfactory from the standpoint of cure as far as ulcer was concerned, because it excised the ulcer, did not make a new stoma, and the surgeon could see the field of operation and attend to kissing or contact ulcers when present. Since the 30th of June, 1920, Doctor Erdmann has done 44 Horsley operations, and in the same period of time there were 133 operations on or about the duodenum. Another reason why he had selected the Horsley was

on account of the number of marginal ulcers he had had referred to him during the last six or seven years. On two occasions he had reported some seven or eight cases. He felt that any operation which would reduce this possibility would be the natural operation of choice. The subsequent symptomatology is far more satisfactory than from the other operations. He had had several late marginal ulcers, one case presented recently in which the ulcer was evident ten years after the original operation. He felt that the Horsley operation cannot be done in all cases of duodenal ulcer; when not feasible then a resection or gastro-enterostomy should be done. He stated that his series of Horsley operations is as yet too small and too recent for a positive declaration, but that the reasons for doing it are well defined. In regard to the antecolonic operation of Polya, this he had debarred the past year from his service on account of obstruction following in three patients and he was under the impression that this operation is being dropped in other clinics, the operators reverting to the original Polya or some form of Billroth.

Dr. Willy Meyer said he took the same position that Doctor Peck had done with regard to the surgical treatment of duodenal ulcer. He considered the subject so large that he could only select a few points for discussion. Mention had been made of pyloric occlusion; his best functional and clinical results had been seen upon this addition and for a while he had practiced it in every case he operated on. If one occludes the pylorus, however, the effect of the presence of bile, which usually enters the stomach after gastro-enterostomy and neutralizes the acidity, is lost for the healing of the duodenal ulcer. Therefore, pyloric occlusion is undesirable.

Many cases are due to syphilis. The report frequently reads "Wassermann negative," but that is not proof of the absence of syphilis. On one occasion lately the speaker found an infiltration which passed over the entire first portion of the duodenum and then on to the stomach. On further examination this was found to be specific.

Doctor Meyer said he also favored Doctor Peck's technic in doing the operation. But after the division of the seromuscular coat of the stomach, he liked to put in a few catgut stitches around the visible vessels before dividing the mucosa. In regard to the vicious circle: only lately the speaker had had such a case in spite of the short-loop operation. He then used the button for an additional entero-enterostomy and the patient got well. He never united the split in the transverse mesocolon to the jejunum, but attached it to the stomach. Surgeons certainly have seen excellent results from gastro-enterostomy. Why, then, not do a gastro-enterostomy first and, if the patient does not get well, a resection at the second stage? One should first do the operation which involves the least danger.

CORRESPONDENCE

TRAUMATIC AVULSION OF THE SCAPULA

EDITOR ANNALS OF SURGERY:

Sir:

In April, 1919, while I was surgeon for a large copper mining hospital in Arizona, a Mexican Indian, twenty-five years of age, from the State of Jalisco, was engaged in greasing the bearings of a shaft in the smelter in which he was employed. His sleeve became caught in the shafting and the left scapula, with the arm attached, was torn from his body. A first-aid dressing was applied, an ambulance summoned and he arrived at the hospital about twenty minutes after the accident occurred. He was in marked shock but there was no active bleeding. There was no artery that required ligation. The wound was dressed while special care was taken to cause the minimum disturbance to the patient. He was then put to bed, hot-water bags applied, and 750 c.c. of normal salt solution with 1 c.c. of adrenalin added was given intravenously.

FIG. 1.—Avulsion of scapula; condition of patient four weeks after the accident.

The accident happened about eight P.M. Next morning he still showed evidence of shock but was much improved. He took plenty of fluids during the day and on the following morning, thirty-six hours after the accident, his condition was so good that he was given an ether anæsthesia and the wound trimmed up and closed. A few ragged pieces were removed from the muscles in the depths of the wound and the skin flaps were approximated with silkworm sutures. The skin flaps readily covered the wound, due evidently to the fact that the sharp edge of the scapula, when

dragged out had cut its own skin-flaps on the way out. There was no area to heal by granulation as the flaps covered everything perfectly. The after convalescence was uninterrupted, and the man was discharged from the hospital with his wound completely healed in four weeks. There was no suppuration in the wound at any time. A noticeable thing about this patient was the fortitude he displayed at all times. He never complained and his unfailing response to queries as to how he felt was a smile and the word "bueno." Possibly this stoical heritage from his Indian ancestors was an important factor in the smooth recovery that he made.

I add a brief resume of former cases reported in the literature:

I. Braithwaite, J.: Lond. M. Gaz., 1832, vol. xi, p. 147. Boy, twelve. Arm caught in strap of carding machine. Profuse bleeding. Recovery.

II. Lond. M. Gaz.: 1830, vol. v, p. 497. Boy eleven. Arm caught in chain attached to steam engine. Recovered in three months.

III. Charles, J. J.: Lancet, Lond., 1872, vol. i, p. 216. Boy, ten. Caught arm in machinery in mill. Separation was not complete. Surgeon completed amputation and tied axillary vessels. Recovery.

IV. Cheselden, W.: Anatomy Human Body, Lond., 1897, 321, 1 pl. Cites case that happened in 1737. Arm caught in rope in mill. Little bleeding. Recovery.

V. Cooper, J. S.: N. York, J. M., 1843, vol. i, p. 284. Boy, seven. Caught in machinery around sugar mill. Two-thirds scapula torn off. Remainder removed. Recovery.

VI. George, W. H.: Eclect. M. J. Cincin., 1897, vol. xxxix, pp. 69–72. Miner caught in shaft of mine by descending cage. Little hemorrhage. Recovery.

VII. Jones, J. E.: Lancet, Lond., 1881, vol. ii, p. 363. Miner, seventeen, caught in shafting. Axillary artery ligated by surgeon. Little hemorrhage. Good recovery.

VIII. Jones, T. E.: Brit., M. J. Lond., 1870, vol. i, p. 545. Boy, eleven, caught in rope attached in revolving shaft. Some hemorrhage and shock. Axillary and two small arteries tied. Recovery.

IX. Lewis, R. F.: North Car. M. J., Wilmington, 1882, vol. x, pp. 197–200. Man, twenty-six. Caught in machinery of steam mill. Little hemorrhage. Recovery.

X. Lowe: Lancet, Lond., 1867, vol. ii, p. 611. Man, eighteen. Caught in carding machine. Axillary artery ligated. Little hemorrhage. Recovery.

XI. Lunn: Brit. M. J., Lond., 1871, vol. i, p. 340. Boy, four. Arm caught in spokes of wagon wheel. Separation of scapula from body not complete. No hemorrhage. Recovery.

XII. Marshall, Ewing: N. York M. J., 1899, vol. lxx, p. 730. Boy, twelve. Hand caught between pulley and belt. Axillary artery ligated. Recovery.

XIII. Mussey, R. D.: Am. J. M. Sc., Phila., 1837, vol. xxi, pp. 385–388. Boy, sixteen. Caught in machinery of cotton factory. Little hemorrhage. Recovery.

XIV. Patmore, T. D.: Brit. M. J. Lond., 1903, vol. i, p. 134. Man, seventeen. Accident not described. Recovery. Worked as postal clerk.

XV. Scarnell, B. F.: Lancet, Lond., 1831–2, vol. ii, p. 114. Boy, thirteen. Caught in machinery in mill. Axillary artery ligated. Recovery.

XVI. Wall, Gregory A.: J. Oklahoma M. Assn., Guthrie, 1918, vol. xi, p. 315. Young man caught in revolving machinery. Very little hemorrhage. Severe shock. Operated in twenty-four hours. Skin graft done sixteen days later. Wound fully healed in two months.

XVII. Will, J. C. O.: Brit. M. J. Lond., 1884, vol. i, p. 1135. Girl, eighteen. Arm caught in revolving cylinder. No hemorrhage. Much shock. Good recovery.

In reviewing the literature one is strikingly impressed with the absence of severe hemorrhage. The torsion on the vessels during the process of avulsion evidently is a most excellent aid to efficient blood clot formation. In nine of the reported cases, as well as in our case, absence of bleeding is noted. Also in view of the fact that all injuries were due to machinery and some time necessarily elapsed before skilled care could be given, any of the cases had opportunity for fatal hemorrhage.

CHAS. G. MCMAHON, M.D.,
Superior, Nebraska.

GALL-BLADDER DISEASE IN YOUTH

EDITOR ANNALS OF SURGERY:
Sir:

In a recent paper in the ANNALS OF SURGERY (May, 1923,) I reported a case of gall-stones in a child eleven years of age and collected from the literature sixty-four cases of gall-bladder disease in children ranging from an eight months' fœtus to fifteen years of age, justifying the conclusion that infections of the gall-bladder in early life are not so rare as has been supposed. The following additional cases are offered as further evidence in support of this conclusion.

CASE I.—E. H., a girl, eighteen years of age, was admitted to Gouverneur Hospital, October 11, 1923. She never had had attacks similar to that for which she applied for admission. Two weeks before she had suffered from an attack of indigestion, which was not severe and quickly subsided. On the evening of the onset she retired feeling well, but was awakened at three A.M. with pain in both hypochondriac regions, more marked on the right. The pain extended to the back but not to the shoulder blade. It was continuous and cramp-like, and after about an hour, was accompanied with vomiting of green-colored fluid. The bowels moved following an enema. When admitted to the hospital she appeared quite ill and was slightly jaundiced. She complained of pain in both upper quadrants of the abdomen extending to the back on the right side. There was rigidity of upper right rectus and tenderness in the region of the gall-bladder. Temperature, 100; leucocyte count, 12,000; pulse, 104; polymorphonuclears, 92 per cent.; respiration, 20. Operation was performed the day of admission. The gall-bladder was found acutely inflamed, greatly distended, did not empty on pressure. Stones could be palpated in the gall-bladder but not in the ducts. Cholecystectomy with drainage was done. The gall-bladder was found to be much thickened and contained a large number of hard stones. Result: Uneventful recovery followed.

CASE II.—S. B., a girl, aged fifteen years, was admitted to Gouverneur Hospital, November 18, 1923. She had been well until two weeks before, when she complained of slight abdominal pain and anorexia. The symptoms subsided under medical treatment. Four days ago she suddenly developed severe general abdominal pain with persistent vomiting. After several days' treatment at home she was brought to the hospital. On admission she appeared acutely ill. She was not jaundiced. There was a board-like rigidity of the entire abdomen, general tenderness to both light and deep pressure. Temperature, 101.2; urine contained a little albumen; pulse, 120; leucocyte count, 12,500; respiration, 33; polymorphonuclears, 90 per cent. Operation was performed immediately. Upon opening the abdominal cavity a general peritonitis was presented. There was a large amount

of bile-stained fluid in the abdomen; the appendix was congested; the gall-bladder was acutely inflamed and covered with bile-tinged exudate; upon its fundus was a small perforation; three stones were palpated, one in the cystic duct and two in the gall-bladder. Cholecystostomy and drainage of abdomen was done. She died in four days from peritonitis.

CASE III.—G. E., a young married woman, aged twenty-two years, was admitted to the New York Polyclinic Hospital, April 19, 1916. Three months previously she had given birth to a child, after a difficult labor. For several weeks prior to coming to the hospital she had had frequent attacks of severe epigastric pain extending to the back; no jaundice and no fever. When admitted she showed marked tenderness under right and left costal arch with rigidity of upper right rectus. The abdomen was opened soon after admission to the hospital. The gall-bladder was found contracted, bound to the liver by dense adhesions and containing numerous small stones; adhesions about the appendix. Cholecystectomy and appendectomy was done. Uneventful recovery followed.

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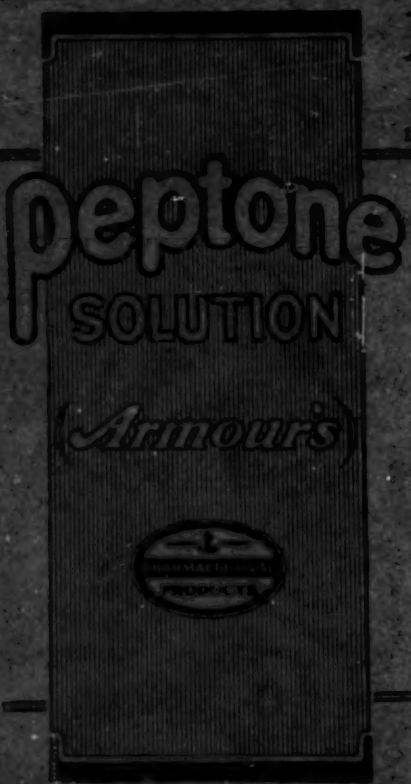

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